

US EPA RECORDS CENTER REGION 5



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OPERATING & MAINTENANCE MANUAL
FOR
ST. LOUIS PARK, MN
ACTIVATED CARBON PLANT

REMEDIAL ACTION PLAN
REILLY TAR & CHEMICAL CORPORATION

CALGON CARBON CORPORATION
P.O. BOX 717
PITTSBURGH, PA 15230

PJC #2-9290-00

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SECTION I

Operating Manual

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1.0 INTRODUCTION

This manual covers a general description of facilities and operating procedures for the groundwater treatment system at the City of St. Louis Park's facilities in St. Louis Park, Minnesota.

The procedures set forth, herein, represent the best information currently available for this system. In the event improved operating techniques are developed in the future by Calgon, such information will be issued for incorporation in this manual.

1.1 Glossary

Adsorber: A tank designed to hold granular activated carbon for the purpose of adsorbing organic contaminants.

Carbon Trailer: A tank on wheels used to transport reactivated or spent carbon.

Heel: Any spent carbon not removed from an adsorber before charging it with fresh carbon.

Reactivated Carbon: Previously used carbon that has been thermally reactivated.

Spent Carbon: Carbon that has adsorbed organic material.

Spray Nozzle: Nozzle mounted in the top center of adsorber and used for flushing out spent carbon.

Underdrain: Device designed to permit the flow of water, but retain carbon in vessel.

Vent: A pressure relief line from an adsorber.

Water Cushion: The water added to an adsorber before charging it with carbon to protect the underdrain and lining.

2.0 DESCRIPTION OF FACILITIES

2.1 General Description

The equipment provided for the groundwater treatment system consists of two free-standing adsorbers complete with underdrain assembly, sample connections, and all process piping.

2.2 Process Description

This process description is a general description of the operation of the granular activated carbon system for the groundwater treatment located in St. Louis Park, Minnesota. The flow diagram should be consulted in conjunction with the description of the facilities.

Contaminated groundwater from customer's Well #10 and Well #15 is pumped to pressure sand filters #3 and #4 which in turn delivers the feed to the carbon adsorption system. The two carbon adsorbers are operated in parallel and in a downflow mode. Provision is there for two additional future adsorbers. A flow totalizer on either feed line indicates the total amount of water to be treated by each adsorber. The adsorbers are each filled with 20,000 pounds of Filtrasorb 300. Filtered water enters the top of the vessels and flows downward through the carbon beds.

Dissolved organic contaminants will be removed from the groundwater by adsorption onto the carbon. The treated water leaving the adsorbers is discharged into the existing 1.5 MM gallon reservoir via FCV-603.

Backwashing of each adsorber after being charged with fresh granular activated carbon is initially required to remove carbon fines. Backwashing of each bed might be periodically required to minimize suspended solids accumulation on the surface of the carbon bed. These solids would cause an increase in the pressure drop across the carbon bed which in turn would restrict the amount of water flow through it.

Backwash water for either adsorber is the treated water from the other (second) adsorber. This water is pumped upflow through the carbon bed by backwash pump P-1.

2.2 Process Description (Cont'd)

The backwash water flow is controlled by a flow totalizer at a rate of 12-15 gpm/ft.² or 950-1,200 gpm/vessel. The backwashing should be performed when the pressure drop across the bed is 30' psig or becomes such that the design flow rate cannot be maintained, whichever is earlier. Backwash water leaving the adsorber is discharged into the client's trench and is finally routed to the sanitary/storm sewer system via the sludge tank.

When the carbon in an adsorber becomes saturated with impurities adsorbed from the groundwater, this adsorber must be taken out of service to replace the spent carbon with fresh carbon. The spent carbon is transferred as a slurry under air pressure to an empty Calgon trailer for return to Pittsburgh for reactivation.

Following the removal of the spent carbon, a fresh charge of activated carbon is transferred from a CCS trailer to the adsorber. To do this, the trailer is filled with treated water, pressurized with air from a portable air compressor, and the activated carbon is transferred to the adsorber. Before the adsorber can be returned to service, it will be back-washed to remove fines.

2.3 Major Equipment Description

The following presents a description of the major capital equipment for the granular activated carbon adsorption system at St. Louis Park, Minnesota.

<u>Item No.</u>	<u>Description</u>
V-1/V-2 Carbon Adsorbers	10'0" O.D. X 14'0" S.S. Carbon steel vessels with Plascite 4110 lining and 304 S.S. underdrain system. Vessel Pressure Rating 150 PSIG.
P-1 Backwash Pump	1200 GPM at 50' TDH, 20 H.P., 1,750 RPM

2.4 Operating Conditions

The design conditions for this system are as follows:

Flow: 1,200 GPM

Temperature: Ambient

Well-head Pressure: 115 PSIG

Pressure Vessel
Rating (Adsorber): 150 PSIG at 70° F

Adsorber Capacity: Approximately 20,000 pounds of
granular activated carbon per
vessel.

3.0 START-UP

3.1 Filling the Adsorbers

The adsorbers are to be filled with carbon from the CCS trailer. The carbon is transferred into the vessels as a slurry through transfer lines connected to nozzles located on the top heads of the vessels. The trailer must be filled with water prior to beginning the transfer sequence. While transferring the carbon, the valves in the transfer lines to the adsorbers and the valves in the vent lines shall be fully open. All other valves should be in the closed position.

The trailer driver/operator will connect the necessary hoses and will operate all valves, control devices, etc. associated with the trailer. Under no circumstances should the hopper trailer be connected to a pressure source greater than 15 psig. The trailer will be pressured by a portable air compressor. When all of the carbon has been transferred from the trailer into the vessels, as evidenced by the sound of the flow through the hose and pipe line, the transfer valves shall then be closed, the trailer pressure vented, and the transfer line disconnected. Also, the vent valves shall be closed.

3.2 Placing the System in Operation

3.2.1 Adsorption System Start-Up

To put the adsorption system on-stream, the procedure is described below.

The feed to the adsorber train is provided by the customer's feed pump. The pump must be started and brought up to operating conditions prior to placing the treating facility in operation. When this has been accomplished, the pump discharge valve is slowly opened. The flow will be controlled at the required settings, and the system shall be put on-stream as follows.
(Consult the Engineering Flow Diagram.)

1. Set the flow at the same value by the flow totalizers leading to either adsorber, V-1/V-2.

3.2.1 Adsorption System Start-Up (Cont'd)

2. Open process valves 2A and 1A feeding adsorbers V-2 and V-1, respectively.
3. Open vent-valves 2J and 1J on adsorbers V-2 and V-1, respectively.
4. Once full line flow is obtained, close vent valves 2J and 1J (vessels V-2 and V-1 are now flooded).
5. Open process valves 2B and 1B, the effluent block valves from V-2 and V-1, respectively, on the treated water line.

The system is on-line with adsorbers V-2 and V-1 in parallel operation. Check to insure that only valves 2A, 1A, 2B, and 1B are open with this mode of operation.

4.0 OPERATING MODES

4.1 Sequence of Events

4.1.1 Description

The purpose of this section is to review the sequence of events which occur when an adsorber needs to be recharged with fresh carbon.

4.1.2 Carbon Delivery and Replacement

When it becomes necessary to replace carbon in an adsorber, the following sequence of events will occur:

- a. Take spent adsorber off-line and run in single stage operation, if possible;
- b. Transfer spent carbon from adsorber to an empty trailer;
- c. Transfer fresh carbon from trailer to empty adsorber;
- d. Backwash the recharged adsorber;
- e. Return freshly filled adsorber to service.

4.2 Spent Carbon Transfer from Adsorber to CCS Trailer

4.2.1 Description

When the carbon in the adsorber becomes exhausted, the adsorber is removed from service, and the exhausted or spent carbon is replaced with fresh carbon.

The spent carbon transfer is accomplished by pressuring the tank with air to transfer the slurry to the trailer. When the transfer is complete, the spent carbon in the trailer is drained of water. Prior to disconnecting any lines, the air supply must be shut off, and the tank and all transfer lines must be vented.

4.2.2 Transfer Spent Carbon to Trailer

(Assume that spent carbon is to be transferred from adsorber V-2.)

A. Prepare for spent carbon transfer.

1. Connect adsorber carbon outlet line, 4" SC-2-C20, to trailer fill line #1 using 4" flexible hose.
2. Open the center manway on the trailer for venting.
3. Open valve #25 in trailer fill line.
4. Close all adsorber valves.

By means of a 3/4" water hose, fill the transfer line with water, using the flushout connection at the carbon outlet valve, 2L. Water in the transfer line will aid the initial phase of transferring the spent carbon.

B. Transfer spent carbon.

1. Open air line valve slowly and pressurize the adsorber to about 30 psig.
2. Open carbon outlet valve 2L and transfer spent carbon to trailer.

The transfer should take 20-30 minutes. The transfer will end with a loss of pressure in the adsorber and the sound of air in the transfer line.

C. Heel removal.

It will be necessary to add a sufficient amount of water to the adsorber at the end of the transfer to insure that all of the spent carbon has been removed from the vessel.

1. At the end of the transfer as noted above, open the water valve 2H in the spray header flush line to the adsorber and flush any spent carbon from the vessel.

4.2.2 Transfer Spent Carbon to Trailer (Cont'd)

2. Leave flush on for about 5 minutes, or until no residual carbon is visible in the line to the truck, and then shut off the water valve to the spray header.

D. End transfer.

1. Close the air line valve.
2. Vent adsorber and lines through trailer vent valve #30.
3. Open the adsorber vent valve 2J to further aid venting.
4. Close carbon outlet valve.

E. Residual heel removal.

1. Open adsorber manway. (The safety precautions discussed in Section 8.3 should be adhered to.)
2. Rinse/flush the sides of the vessel for about five minutes, or until they are free of any residual carbon.
3. Replace the manway.
4. Follow Step B above.
5. Follow Step D above.

4.2.3 Drain Water from Trailer

A. Prepare for draining water from trailer.

1. Close all valves on the trailer except valve #25 in fill line #1.
2. Connect plant air line to trailer fill line #1 using the air line hose.
3. Connect line #2 on the trailer to drain line in trench by means of a 4" flexible hose.

4.2.3 Drain Water from Trailer (Cont'd)

B. Draining trailer.

1. Pressurize the trailer to 15 psig by slowly opening the air line valve.
2. Open trailer septa valves #26, 27, and 28.

By pressurizing the trailer, the water will be drained in less time than it would be if drained by gravity.

C. End draining.

1. When the carbon is completely drained, close the air line valve to the trailer.
2. Vent trailer slowly through vent valve #30.
3. When the venting is complete, close all valves on the trailer and disconnect all hoses.

The trailer is now full of drained, spent carbon and is ready for return to Calgon for carbon reactivation.

4.3 Fresh Carbon Transfer from Trailer to Adsorber

4.3.1 Description

When spent carbon is exhausted it will be replaced with fresh carbon from Calgon. The fresh carbon will be transferred in a slurry by means of air pressure. The trailer is first filled with water to create the slurry. The carbon slurry hose on the trailer is connected to the adsorber fill line and the trailer carbon outlet line. After putting a water cushion in the adsorber, the trailer is pressurized and the carbon slurry is transferred into the empty adsorber. Prior to disconnecting any lines, the air supply must be shut off, and the trailer and all transfer lines must be vented.

4.3.1 Description (Cont'd)

Under no circumstances should the trailer be connected to a pressure source exceeding 15 psig.

4.3.2 Fill Trailer with Water

A. Filling Operation

1. Connect water line to trailer fill line #1 using a 4" flexible hose.
2. Open one top manway to vent the trailer during filling.
3. Open trailer vent line valve #30.
4. Open trailer fill line valve #25.
5. Open treated water line valve slowly and fill trailer.

The trailer is filled with approximately 3,000 gallons of water. The trailer filling shall be visually determined by observing the water level through the manway or by metering the desired amount.

B. End filling operation.

1. Close the water line valve.
2. Close trailer fill line valve #25, manways and vent valve #30.
3. Disconnect hose.

4.3.3 Transfer Carbon to Adsorber

(Assume adsorber V-2 is to be filled with virgin carbon.)

A. Prepare for transfer.

By means of the spray header, place about 2,000 gallons of water in the adsorber by opening valve 2H. This serves as a "water cushion" to reduce carbon abrasion and protect the underdrain system.

4.3.3 Transfer Carbon to Adsorber (Cont'd)

A. Prepare for transfer. (Cont'd)

1. Connect adsorber fill line, 4" VC-2-20, to trailer carbon outlet line #2 using 4" flexible hose.
2. Connect the air line to trailer fill line #1 using the air line hose.
3. Close all valves on adsorber.
4. Open adsorber vent valve 2J.

By means of a 3/4" water hose, fill the transfer line with water, using the flushout connection at the carbon fill valve, 2K. Water in the transfer line will aid the initial phase of transferring carbon.

B. Transfer fresh carbon.

1. Pressurize the hopper trailer to 15 psig by slowly opening the air line valve and then slowly opening valve #25 in the trailer fill line.
2. Open adsorber fill line valve 2K.
3. Open the trailer carbon outlet valves VT-1, VT-2, and VT-3 individually to empty the respective hoppers.

Be certain to open only one valve at a time, with the other two closed. Open the center section first, then the front and then the back (back is where the hoses are connected). Keep each open for about 3 to 5 minutes to empty the trailer in an even manner.

4. If a water cushion is utilized, open the adsorber drain 2C shortly into the transfer to reduce water overflow at the end of the transfer.

4.3.3 Transfer Carbon to Adsorber (Cont'd)

C. End transfer.

1. Close the air line valve and vent the trailer through adsorber vent valve 2J.
2. Close the adsorber drain valve 2C, if utilized during transfer.
3. Slowly open trailer vent valve #30 for additional venting purposes.
4. When completely vented, close the adsorber fill line valve, disconnect the hoses, and close all trailer valves.
5. Run spray water into the adsorber until water comes out of the vent line.
6. Shut off the spray water and close the vent valve on the adsorber.

The adsorber is now filled with virgin carbon and is ready for defining.

4.3.4 Backwash Adsorber to Remove Fines

The backwash of adsorber V-2 will be performed with the feedwater to adsorber V-1. The purpose of the backwash is to remove fines from a freshly charged carbon bed.

1. Open feedwater valve 1A and the treated water valve 1B for adsorber V-1.
2. Start the backwash pump P-1.
3. Open the pump discharge valve and the backwash inlet valve 2D for adsorber V-2.
4. Open the backwash outlet valve 2G for adsorber V-2 and let the backwash water drain to trench.

4.3.4 Backwash Adsorber to Remove Fines (Cont'd)

5. Continue backwashing until there are no fines in the backwash effluent line.
6. Shut down the pump and close all valves.

The adsorber V-2 is now ready to be returned to service. A similar procedure is to be followed when filling adsorber V-1 with virgin carbon.

4.4 Sand Filter

It is essential that the City of St. Louis Park, MN, operate and maintain the sand filters in such a way that the influent to the carbon system has ≤ 5 mg/l suspended solids and ≤ 0.1 mg/l total iron.

5.0 TROUBLESHOOTING

<u>Problem</u>	<u>Probable Cause</u>	<u>Remedy</u>
High pressure across adsorber.	Bed not flooded. Bed air bound.	Open vent valve to release pressure. Make sure there is a constant flow before closing the valve.
	Feed pump pressure too high.	Throttle feed pump.
	High suspended solids loading.	Test feed sample for suspended solids. Install a filter on influent line. If the above test is positive, backwash the adsorber. If all of the above fail, call Calgon at 412/787-6700.
	Improper valving.	Check valve sequence. Check for obstructions in transfer lines.
Leaking flange.	Loose bolts.	Tighten bolts.
Excessive flow out of vent line.	Broken rupture disc.	Replace rupture disc.
Carbon in effluent.	Internal mechanical failure.	To confirm, open effluent sample valve. Collect 1 quart effluent sample to check carbon level. If the above confirms mechanical failure, call Calgon at 412/787-6700.
Premature breakthrough.	Change of influent concentrations.	Confirm by checking effluent samples before changing carbon.
	Syphoning air in influent.	Open vent valve to check if bed is flooded.

5.0 TROUBLESHOOTING (Cont'd)

<u>Problem</u>	<u>Probable Cause</u>	<u>Remedy</u>
Premature breakthrough.	Background TOC Colloids	Change carbon.
Carbon heel in emptied vessel.	Insufficient spray water.	Increase water flow through sprays.
	Mechanical failure.	Repair or change spray nozzles.
	High suspended solids.	Install filter.
	Cemented bed.	Notify Calgon at 412/787-6700.
Sudden high contaminant level in effluent.	Carbon heel due to improper transfer.	Wait until contaminant flushed out and review transfer technique.
Frozen lines, broken gauges valves.	Cold weather.	Drain stagnant piping, insulate and/or heat trace process, spray water and vent lines. As a last resort, call Calgon at 412/787-6700.

6.0 MONITORING SERVICES

A spent carbon sample will be returned by the customer to Calgon for a reactivation study to determine the carbon's acceptability.

Notes:

(1) OSHA Regulated Substances

If the influent to the carbon adsorption system is suspected of containing a chemical substance or mixture defined as an OSHA human carcinogen (OSHA - General Industry Safety and Health Standards 29, Code of Federal Regulations 1910) the customer must notify Calgon.

(2) Toxic Substances Control Act

If the influent to the carbon adsorption system is suspected of containing a chemical substance or mixture for which the disposal is regulated under the Toxic Substances Control Act (Section 6, paragraph 6) the customer must notify Calgon.

7.0 PILOT COLUMN SYSTEM

A rack mounted pilot column system has been provided to predict the breakthrough of PAH compounds or evaluate alternative activated carbon products. The column assembly consists of four 4" diameter glass columns mounted on a free-standing steel frame. The columns are valved and piped for series, parallel, or a combination of series/parallel operation. All components are glass, teflon, or stainless steel to insure no possible PAH leaching from the system internals. Valves are included for sampling treated water from the bottom of each column. In addition, each column has been equipped with three sample taps at intermediate points across the carbon bed.

The purpose of the pilot columns is to simulate the hydraulic loading rate and carbon bed depth of the full size system. A flow rate of 0.67 gpm in the pilot system will simulate a flow rate of 600 gpm through each vessel in the full scale system. A carbon bed depth of 9 feet will duplicate full vessel operation. Columns are prepared for operation in the following manner:

1. Remove the column taps and add water to each column until they are about half full.
2. Add carbon to each column to a desired depth. The carbon bed should allow sufficient room for 50% expansion during backwash. Measure the carbon depth for later calculation of breakthrough and capacity.
3. Reassemble the columns, fill with water, and check for leaks. Soak overnight to properly wet the carbon.
4. Align valves for backwashing. Backwash each column individually at a rate of 1 gpm for a period of 10 minutes. This will produce about 30% bed expansion with effective removal of fines and segregation of beds by particle size.
5. Realign the valves for downflow operation and begin treatment of filtered water at the desired rate.

Some columns may require backwashing during the test period if flow is restricted by excessive build-up of solids. When operated properly, the pilot column will require the same time period to exhaust as the full scale system for an equivalent media depth.

8.0 GENERAL SYSTEM INFORMATION

8.1 Shutdowns

During shutdown, the feed pump shall be shut down, and the adsorption system shall be left full of water. All process valves shall be closed and the adsorber vents shall be open for the duration of the shutdown. Upon restart, the adsorber shall be backwashed.

8.2 Emergency Procedures

If a major leak or failure occurs which would cause the adsorption system to be inoperative, then the feed to the system should be shut down immediately. If repairs are beyond the scope of the plant operators, the Operations Department at Calgon should be contacted immediately.

8.3 Safety

8.3.1 Oxygen Demand Created by Activated Carbon in Confined Vessels

Research efforts have confirmed that wet granular activated carbon confined in large vessels creates an oxygen demand which is hazardous to human health and can cause death unless proper safety precautions are observed.

Studies conducted have shown that low oxygen content exists in vessels containing wet drained carbon. Laboratory experiments conducted since that time also have revealed that commercial activated carbons in a wet or moist condition will lower the oxygen content of an isolated space. Preliminary indications of this research are:

- A. The phenomenon occurs with wet drained activated carbon of all common types.
- B. The rate of oxygen uptake naturally varies with the degree of exposure of the wet carbon to the air. Thus, it is relatively rapid in a drained bed.

8.3.1 Oxygen Demand Created by Activated Carbon in Confined Vessels (Cont'd)

C. There is some indication of a limit to carbon's capacity for oxygen, but until more is known, it would be prudent to assume that all carbon (fresh, used, reactivated) will also exhibit this characteristic. Similarly, although these tests were run with water, it should be assumed that the phenomenon will occur in other liquid and vapor systems.

8.3.2 Note

ALL CONFINED SPACES, INCLUDING THOSE CONTAINING ACTIVATED CARBON, SHOULD BE PRESUMED TO BE HAZARDOUS. APPROPRIATE SAFETY MEASURES SHOULD ALWAYS BE TAKEN BEFORE ENTERING, AS WELL AS WHEN WORKERS ARE IN A CONFINED SPACE. OSHA REGULATIONS APPLICABLE TO RESPIRATORY PROTECTION IN OXYGEN-DEFICIENT ATMOSPHERES SHOULD BE STRICTLY ADHERED TO.

8.4 General Process Comments

8.4.1 Carbon Replacement Schedule

Normally, the replenishment of the carbon will be on an as requested basis. A two week lead time should be sufficient for carbon replacement under normal circumstances. The contact for carbon scheduling is Calgon Operations Department. The telephone number is 412/787-6700.

8.4.2 Operational Changes

Optimum operation of the facility is obtained if changes to the system occur slowly. Rapid changes in flow will cause upsets to the adsorbers which could adversely affect the operation. Valves should be turned slowly at all times to prevent hydraulic shock.

9.0 MAINTENANCE

9.1 Minor Maintenance

Minor maintenance is that frequent maintenance to be performed by the City of St. Louis Park, MN, to insure continuous and effective operation of the Calgon facility. This maintenance includes visual check of pressure gauges and adjustments to valves and regulators, checking and replenishing lubricating oil, tightening flanges and connections to eliminate leakage, rupture disc replacement, etc.

9.2 Major Maintenance

Major maintenance is that effort needed to repair or replace equipment in order to continue system operation. The need for major maintenance would result from a major malfunction causing the system to be inoperative.

Major maintenance also refers to system design changes and/or maintenance requiring downtime.

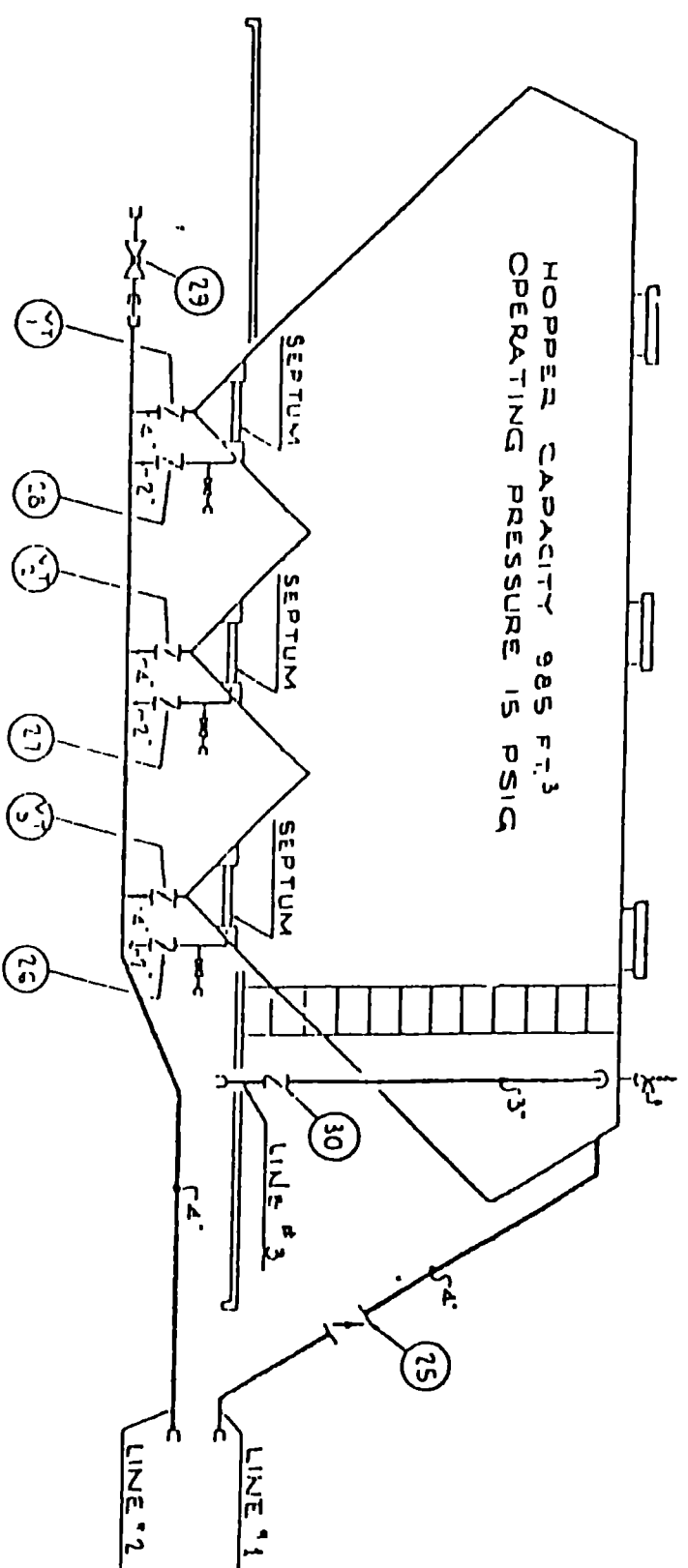
Calgon will perform major maintenance, which consists of repairs to vessel linings and underdrains, on the equipment supplied for a period of three (3) years commencing with the on-line start-up. This major maintenance will be performed only at the time of carbon replacement.

9.3 Spare Parts

Calgon will maintain a spare parts inventory on-site for those items which experience indicates may be required for minor maintenance.

Calgon maintains a large equipment inventory at regional warehouses for all major maintenance requirements and to replenish on-site inventories.

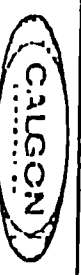
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1. HOPPER CAPACITY 985 F.T.³
 2. OPERATING PRESSURE 15 PSIG
 3. SEPTUM
 4. SEPTUM
 5. SEPTUM
 6. LINE #1
 7. LINE #2
 8. LINE #3
 9. 3'
 10. 14'-2"
 11. 14'-2"
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CALSON
 ADSORPTION SYSTEMS



SUBSIDIARY OF MORGAN & CO., INC.
 P.O. BOX 100 • TOWNSHIP, PA. 17170

UNIT STANDARD

SCHEMATIC DIAGRAM
 CARBON TRAILER

7209A-105

SECTION II

Flow Diagram

SECTION III

Piping Specifications

CALGON CORPORATION
PITTSBURGH, PA.

FOR

CCS
STANDARD PLANT

CCS TREATMENT PLANT

SPECIFICATION NO. 7209A-PS1
FOR
PIPING MATERIALS

APRIL 24, 1973

REVISIONS

This specification has been revised as indicated below and the new pages added and/or the existing pages revised are attached as replacement for those previously issued.

<u>REV.</u>	<u>DATE</u>	<u>BY</u>	<u>PAGE</u>	<u>REMARKS</u>
0	4-26-73	RLB	All	Issued for Purchase
1	5-26-76	ABC	2, 3	Revised and Reissued for Purchase and Construction
2	11-20-78	WAB		Recised Pl and Added PLA
3	5-8-79	WAB		Added hose banding detail
4	12-13-79	WAB		Title Update

PS1.1-3

1.0 SCOPE

- 1.1 This specification covers all materials for Piping and Piping Items to be furnished for Calgon Adsorption System installations.**

2.0 MATERIALS AND DESIGN

- 2.1 All materials shall conform to this specification and the attached detail specifications comprising the complete piping material specification.**
- 2.2 All items shall be standard products of reputable Manufacturers.**
- 2.3 All items shall be new, free from defects and imperfections, and shall be of recent manufacture.**
- 2.4 Any deviations from this specification shall be clearly stated in writing by the Seller.**

3.0 APPLICABLE PUBLICATIONS

- 3.1 The publications of the organizations listed below form a part of this specification to the extent indicated by the references thereto:**

3.1.1 American National Standards Institute (ANSI) Standards

Dimensions of pipe, flanges, fittings and piping accessories shall conform to the standards listed. Basic designation of the applicable document forms part of the detail specification for each piping item in the section covering Piping Materials.

3.1.2 American Society for Testing Materials (ASTM) Specifications

Materials for pipe, flanges, fittings and piping accessories shall conform to the specifications listed. Basic designation of the applicable document forms part of the detail specification for each piping item in the sections covering Piping Materials.

4.0 PIPING NOMENCLATURE

- 4.1 Contract Drawings include flow diagrams, detailed piping drawings and spool sheets. The flow diagrams show the piping systems in schematic form and the detailed piping drawings show the actual arrangement and physical layout of the piping systems in each area. Spool sheet drawings show isometric details of piping and give a material list.**

PS1.2

4.0 PIPING NOMENCLATURE (Cont'd)

- 4.2 Pipeline designations on the Contract Drawings identify each pipeline. This designation is comprised of four parts as described for the following example:**

14 RC 15 C1

where the prefix "14" is the nominal size of the pipeline in inches, the symbol "RC" is the line service designation, the number "15" is the individual line number, and the suffix "C1" is the Piping Material Specification, included herein.

Lines are usually numbered consecutively and are inclusive from one definite point, or piece of equipment, to another.

- 4.3 Valves and other piping specialties are identified on the Contract Drawings by the Item No., followed by the size enclosed in a block. For example:**

1.01

2"

where 1.01 is the Item No. for a specific valve described in the Piping Material Specification and 2" is the valve size.

5.0 ATTACHMENTS

- 5.1 Detail specifications for pipe, fittings, valves and specialties constitute the attachments to this specification. Inasmuch as the material requirements for each project are different, the actual applicable detail specification will be as designated on the contract drawings and in the bills of materials.**

PS1.3

**SPECIFICATION FOR
PIPING MATERIALS**

**CALGON CORPORATION
SPEC. NO.**

Revised 2/26/76
12/13/79
2/26/80
1/16/84
4/06/84

PIPING MATERIAL SPECIFICATION C2

MATERIAL	Carbon steel pipe with steel fittings.
RATING	150 PSIG @ .500 F Includes corrosion allowance of 0.050" minimum.
CONSTRUCTION	Screwed for 1 1/2" and smaller. Welded and/or flanged for 2" and larger.
PIPE	Carbon Steel, ASTM A53, Grade B: Threaded, schedule 80, seamless, 1 1/2" and smaller. Plain end, schedule 40, seamless, 2" to 12" Plain end, 3/8" wall, seamless, 14" to 24"
FITTINGS	3000 lb., ANSI B16.11, forged steel, threaded ends, 1 1/2" and smaller. Schedule 40, ANSI B16.9, ASTM A234, Grade WPA, carbon steel, butt welding ends, 2" to 12". 3/8" wall, ANSI B16.9, ASTM A234 Grade WPA, carbon steel, butt welding ends, 14" to 24".
UNIONS	3000 lb., forged steel, ASTM A105, Grade 2, integral steel seat, ground joint, threaded ends.
FLANGES	150 lb. ANSI B16.5, ASTM A181, Grade 1, forged carbon steel, slip-on or weld neck type 2" and larger, threaded 1 1/2" and smaller. Where bolting to flat face cast iron flanges, steel flanges shall be furnished with a flat face; others shall be raised face.
ORIFICE FLANGES	Instrument item.
BOLTING	Standard hex head machine bolts, carbon steel, ANSI B18.2, ASTM A307, Grade B, with one heavy semi-finished hexagon nut per bolt. (Cadmium Plated).
GASKETS	Flat ring type for raised face joints, full face for flat face joints, 1/8" thick, dimensions to conform with ANSI B16.21. Red Rubber, Johns-Manville No. 107, or equal.

PIPING MATERIAL SPECIFICATION C5

MATERIAL	Carbon steel pipe with iron or steel fittings
RATING	10 PSIG @ 250°F
CONSTRUCTION	Screwed for 3" and smaller. Welded and/or flanged for 4" and larger. No bending permitted.
PIPE	Carbon steel, ASTM A120, Grade A: Threaded schedule 40, welded, 3" and smaller. Plain end, schedule 40, welded or seamless, 4" and larger.
FITTINGS	150 lb., ANSI B16.3, ASTM A47, malleable iron, banded, threaded ends, 3" and smaller. Schedule 40, ANSI B16.9, ASTM A234, Grade WPA, carbon steel, butt welding ends, 4" and larger.
UNIONS	150 lb., ASTM A47, malleable iron, integral iron seat, ground joint, threaded ends.
FLANGES	150 lb., ANSI B16.5, ASTM A181, Grade I, forged carbon steel, threaded 3" and smaller, slip-on or weld neck type 4" and larger.
ORIFICE FLANGES	Instrument Item
BOLTING	Standard hex head machine bolts, ANSI B18.2, ASTM A307, Grade B. with one heavy semi-finished hexagon nut per bolt. (Cadmium Plated)
GASKETS	Flat ring type for raised face joints, full face for flat face joints, Red Rubber, 1/8" thick, Johns-Manville No. 107, or equal, dimensions per ANSI B16.21.

**SPECIFICATION FOR
PIPING MATERIALS**

**CALTEX CORPORATION
SPEC. NO.**

Revised 6-21-75
2-23-76
8-9-76
12/13/79

PIPING MATERIAL SPECIFICATION C13

MATERIAL	Galvanized carbon steel pipe with galvanized iron or steel fittings
RATING	100 PSIG @ 220°F - Water Service 125 PSIG @ 350°F - Steam and Air Service Includes corrosion allowance of 0.050" minimum
CONSTRUCTION	Screwed 3" and smaller No bending permitted
PIPE	Galvanized carbon steel, ASTM A120: Threaded, schedule 80, butt welded seam 2" and smaller Threaded, schedule 40, butt welded seam or seamless, 2½" and 3"
FITTINGS	150 lb., ANSI B16.3, ASTM A197, galvanized malleable iron, banded, threaded ends
UNIONS	150 lb., ASTM A197, galvanized malleable iron, integral iron seat, ground joint, threaded ends
FLANGES	150 lb., ANSI B16.5, ASTM A181, Grade I, galvanized forged carbon steel, threaded Where bolting to flat face cast iron flanges, steel flanges shall be furnished with a flat face. Others shall be raised face.
ORIFICE FLANGES	Instrument item
BOLTING	Standard square head machine bolts, ASTM A307, Grade B, ANSI B18.2, with one heavy semi-finished hexagon nut per bolt
GASKETS	Flat ring type for raised face joints, full face for flat face joints, 1/8" thick, dimensions to conform with ANSI B16.21. Red Rubber, Johns-Manville No. 107, or equal.

PIPING MATERIAL SPECIFICATION C20

MATERIAL	Heavy steel pipe with steel fittings.
RATING	150 psig @ 500°F Includes corrosion and/or abrasion allowance of 0.100" minimum (intended for carbon transfer service).
CONSTRUCTION	Butt welded or flanged 1 1/2" and larger.
PIPE	Carbon steel ASTM A53, Grade B, plain end, schedule 80 seamless 1 1/2" to 12"
FITTINGS	Schedule 80 ANSI B16.9, ASTM A234, Grade WPB carbon steel, butt welding ends, 1 1/2" to 12"
FLANGES	150 lbs., ANSI B16.5, ASTM A181, Grade I, forged carbon steel, slip-on or weld neck type. Where bolting to flat face cast iron flanges, steel flanges shall be furnished with a flat face; all others shall be raised face type.
BOLTING	Standard hex head machine bolts, ANSI B18.2 ASTM A307, Grade B, carbon steel with one heavy semi-finished hex nut per bolt.
GASKETS	Flat ring type for raised face joints, full face for flat face joints, 1/8" thick neoprene.

PIPING MATERIAL SPECIFICATION C21

MATERIAL	Cement lined ductile iron.
RATING	150 psig @ 150°F.
CONSTRUCTION	Mechanical joints for 3" through 24".
PIPE	Ductile cast iron pipe per ANSI A21.51 and AWWA C151, with standard thickness cement lining per ANSI/AWWA-C104/A21.4.
FITTINGS	Mechanical joint cement lined ductile iron fittings, 250 psig pressure rated (3" through 12") and 15 Ø psig (14" through 24"). Fittings shall meet all applicable requirements of ANSI A21.10 (AWWAC110) and ANSI A21.11 (AWWAC111), and exterior shall be tar coated.
FLANGES	Cast iron mechanical joint type per ANSI A21.11 (AWWAC111) tar coated.
BOLTING	High strength, corrosion resistant alloy mechanical joint bolts with tee head and hexagon nut.
GASKETS	Formed rubber gaskets with lead tip bonded to the rubber for electrical continuity.

PIPING MATERIAL SPECIFICATION C22

MATERIAL Reinforced concrete pipe with reinforced concrete fittings.

RATING Atmospheric pressure at 150°F
(Intended for storm sewer use)

CONSTRUCTION Offset pipe with rubber gasket joints.

PIPE Pipe conforming to ASTM C76 for reinforced concrete culvert, storm drain and sewer pipe, for classes II, III, IV and V.

Use Class II with cover 10' or less.
Use Class III with cover 10'-15'
Use Class IV with cover 15'-25'
Use Class V with cover over 25'.

FITTINGS Both long and short radius bend shall conform to ASTM C76 for Classes, III, IV, and V.

Use Class III with cover 15' or less.
Use Class IV with 15'-25' cover.
Use Class V with cover over 25'.

GASKETS Tylox "CR" rubber gaskets, or equal, per ASTM C443.

PIPING MATERIAL SPECIFICATION P1

MATERIAL	PVC plastic pipe with PVC plastic fittings.
RATING	150 PSIG @ 75°F
CONSTRUCTION	Screwed PVC for 1 1/2" and smaller. Socket Type for 2"-4"
PIPE	PVC Type 1, Grade 1, ASTM D1785, Schedule 80, threaded ends, 1 1/2" and smaller; Schedule 40, Socket Type, 2"-4"
FITTINGS	PVC Type 1, Grade 1, ASTM D2464, Schedule 80, threaded ends, 1 1/2" and smaller; Schedule 40, Socket Type, 2"-4"
UNIONS	PVC Type 1, Grade 1, ASTM D2464, Schedule 80, threaded ends, 1 1/2" and smaller.
FLANGES	150 lb., ANSI B16.5, PVC Type 1, Grade 1, threaded or socket type, 1 1/2" and smaller. (Socket Type 2"-4")
ORIFICE FLANGES	Instrument item
BOLTING	Standard hex head machine bolts, carbon steel, ANSI B18.2, ASTM A307, Grade B, with one heavy semi-finished hexagon nut and two plain type A washers, ANSI B27.2, per bolt. (Cadmium Plated)
GASKETS	Full face type for flat face joints, 1/8" thick, Johns-Manville No. 104 Neoprene stock, 55-65 Durometer hardness, or equal, with dimensions per ANSI B16.21.

PIPING MATERIAL SPECIFICATION P10

MATERIAL PVC pipe for low pressure underground gas service.

RATING 5 PSIG @ ambient temperature.

SIZES 1/2" through 8" pipe.

PIPE 1/2" through 1 1/2" schedule 40 PVC pipe per ASTM D1784 and D1785. 2" and above SDR 13.5, 315 PSI per ASTM D2513.

FITTINGS Schedule 40 PVC joined by PVC solvent cement. Threaded fittings shall not be used. Approved compression type couplings and adapters may be used for transition to steel pipe.

PIPING SPECIALTIES SPECIFICATION 8

CHECK VALVES

- 8.01** Check valve, horizontal or vertical swing type. ASTM A-126, Class B cast iron body, all iron mounted, regrinding steel disc, screw-in cap, threaded ends. Jenkins Fig. 72, or equal.

Rating: 250 psig WOG @ 100°F

Sizes: 1/2" thru 2"

- 8.02** Check valve, horizontal or vertical swing type. ASTM A-126, Class B cast iron body, bronze mounted, regrindable - renewable disc and seat ring, bolted cover, 125 lb. ANSI B16.1 flanged ends. Jenkins Fig. 624, or equal.

Rating: : 125 psig saturated steam
200 psig WOG @ 100°F

Sizes: 2" thru 12"

- 8.03** Check valve, horizontal or vertical swing type. ASTM A-126, Class B cast iron body, all iron mounted, regrindable - renewable disc and seat ring, bolted cover, 125 lb. ANSI B16.1 flanged ends. Jenkins Fig. 85, or equal.

Rating: 200 psig WOG @ 100°F

Sizes: 2" thru 12"

- 8.04** Check valve, horizontal or vertical swing type, cast steel body, ASTM A-216, Grade WCB, trim ASTM A-182, Grade F6 (type 410 chromium steel), flanged ends. Crane figure 159X, or equal.

Rating: 300 psig per ANSI B16.5

Sizes: 2" thru 10"

- 8.06** Reduced pressure backflow preventer assembly, consisting of two independent spring-loaded check valves, a differential pressure relief valve, two gate valves and four test corks for field testing. Neptune Model 575, Febco Model 835 or equal, meeting requirements of AWWA, ASSE, and IAMPO. Construction should be cast iron or brass with threaded connections.

Rating: 150 psig @ 140°F

Sizes 3/4" through 2"

Revised 6-7-76

7-6-76

8-2-76

PIPING SPECIALTIES SPECIFICATION 4

BALL VALVES

- 4.01 Malleable iron or carbon steel body full bore ball valve, chromium plated steel ball, steel stem, TFE seats and seals, wrench operated, threaded ends.**

Rating: 400 psig @ 300°F

Sizes: 1/4" thru 1 1/2", W-K-M Type B138, or equal

- 4.02 Cast iron body full bore ball valve, chromium plated steel ball, steel stem, TFE seats and seals, wrench operated, 150 lb. ANSI B16.5 flanged ends, flat face. Face-to-face dimensions to conform to ANSI B16.10 for steel gate valves.**

Rating: 200 psig @ 300°F

**Sizes: 2" and 3", W-K-M Type B111, or equal
4" and 6", W-K-M Type B112, or equal**

- 4.03 Bronze or forged brass or barstock brass body regular port ball valve, blow-out proof stem, ball and seat retainer design to permit valve to be dead ended in either flow direction, bronze or brass ball and stem, TFE seats and seals (furnish glass fiber reinforced TFE seats and graphited asbestos stem seal if required to meet pressure and temperature rating), wrench handle operated, threaded ends.**

**Rating: 500 psig @ 100°F
150 psig @ 366°F**

Sizes: 1/4" thru 2"

**Models: Powell "CRESCENT" Figure 4210R, or equal
Worcester "WOVCO" 600, Figure No. 5811R, or equal
Clayton Mark-Pacific Valve Figure No. BR-880-I-T, or equal
Jamesbury "CLINCHER" Code No. 2111, or equal
Consolidated Valve Industries "APOLLO" 70 Series, or equal
Rockwood Figure 105S, or equal**

PLUG VALVE SPECIFICATIONS

- 6.05 Cast Stainless Steel Plug Valve, Type 316, tapered plug, TFE sleeve, bolted gland, wrench operated, threaded ends.
Duriron Figure G-12, or equal.

Rating: 150 psig at 400°F and 275 psig WOG

Sizes: 1/2" through 2"

- 6.06 Cast Stainless Steel Plug Valve, Type 316, tapered plug, TFE sleeve, bolted gland, 150 lb. ANSI B16.5 flanged ends, raised face.
Unichem No. 15A2LL, or equal.

Rating: 175 psig at 400°F and 275 psig at 100°F

Sizes: 1/2" through 3" - wrench operated
4" and 6" - totally enclosed gear operators

- 6.07 Semi-steel body, eccentric plug valve, bronze plug and bearings, Buna stem seal, Mycar plug seal, wrench lever operated, screwed ends.
DeZurik Figure 425, or equal.

Rating: 175 WOG @ 180° max

Sizes: 1/2" thru 4"

- 6.08 TFE lined, ductile iron body plug valve. All wetted parts to be lined with virgin TFE (polytetrafluoroethylene). Wrench operated, 150 lb. ANSI B16.5 flanged ends, 150 lb. ANSI B16.10 face-to-face dimensions.
Duriron Durco T-line, or equal.

Rating: 220 psig @ 100°F
165 psig @ 300°F

Sizes: 1" through 4"

MISC. VALVE SPECIFICATIONS

- 3.12 Butterfly valve with threaded-lug type ductile cast iron body (ASTM A536), ductile iron disc, type 304 S.S. stem, fiberglass-reinforced teflon bearings, Buna-N cartridge type liner with rigid phenolic back-up ring. Ten-position manual lever for 2" thru 6" size, manual gear operator for 8" thru 24" size. Suitable for mounting between 125# F-F flanges. Furnish chainwheel operators where shown on drawings. Valves shall be Crane Company Type 23-FRB for 2"-12", Type 23N-FRB for 14" thru 24" size. Valves to be certified for compliance with AWWA C504 for Class 150B valves (except for face-to-face dimensions).

Rating - 200 psig @ 180deg. F, 2" thru 12" size
 - 150 psig @ 180deg. F, 14" thru 24" size.

- 1.14 Iron body, bronze mounted, double disc, parallel seat gate valve designed for underground service, conforming to AWWA Specification C-500, non-rising stem. Clow Fig F-5065 or equal. Valves to have 2" inch square operating nuts and valve box (see B/M for depth of cover), mechanical joint ends with lead tipped rubber gaskets and bolts.

Rating - 2" thru 12" - 200 psi @ 180°F
 14" thru 24" - 150 psi @ 180°F

Sizes - 2" thru 24"

- 8.05 Wafer type check valve ASTM A-182 cast iron body and ASTM A-536 ductile iron insert, Buna-N covered, ductile iron plates cadmium plated, 304 SS stem, 316SS springs, Centerline CLC or equal. Body to have lugs with four alignment holes for mounting between 125 or 150 pound flanges.

Rating: 150 psi @ 175°F
Sizes: 2" through 24"

- 21.95 Automatic air vent with check valve to prevent air from reentering system. Cast iron body with stainless steel float, brass and stainless trim, female NPT threaded inlet and outlet. Outlet with steel nipple and brass check valve mounted.

Crespin pressure air valve, manufactured by Multiplex Manufacturing Co., 600 Fowler Ave., Berwick, PA 18603.

<u>Size</u>	<u>Model #</u>	<u>Orifix Dia.</u>	<u>Working Pressure</u>
1"	N10	1/4"	0-150 psig
2"	N20	5/16"	0-150 psig
2 1/2"	N250	7/16"	0-150 psig
3"	N30	1/2"	0-150 psig
4"	N40	5/8"	0-150 psig

Rating: 150 psig @ 150°F

SIGHT FLOW INDICATORS

- 23.28 Sight Flow Indicator, full view type, no internal indicator. For horizontal flow, vertical up-flow or vertical down-flow mounting. Heavy duty Pyrex inner cylinder with a heavy duty Plexiglas protective outer cylinder, Viton seals, polypropylene female NPT end fittings with cadmium plated studs and nuts.**

Corr Tech, Inc. PLAST-O-MATIC Series "G", or equal.

Rating: 150 psig @ 75°F

<u>SIZE</u>	<u>VISUAL LENGTH</u>	<u>PART NUMBER</u>
1/2"	2-1/4"	GY050V
3/4"	2-1/4"	GY075V
1"	2-1/4"	GY100V
1-1/4"	2-1/2"	GY125V
1-1/2"	2-1/2"	GY150V
2"	3-1/8"	GY200V
3"	3-3/8"	GY300V

- 23.29 Sight Flow Indicator, full view wafer type, no internal indicator. For horizontal flow, vertical up-flow or vertical down-flow mounting. Heavy duty Pyrex inner cylinder with a heavy duty Plexiglas protective outer cylinder, Viton "O" rings and polypropylene end pieces.**

**Construction to be in accordance with PLAST-O-MATIC VALVES, INC.
Drawing 942A.**

Rating: 150 psig @ 75°F

Mounting: For insertion between Std. 150# ANSI F.F. flanges

Sight Length: Approx. 3 1/2"

Sizes: 3" & 4"

HOSE

- 31.05 Flexible rubber pipe with black rubber outer cover, multi-ply carcass construction with helical body wire, rubber tube, integral built-up duck and rubber full faced flanges with 150 lb. ANSI B16.5 drilling. End-to-end length to be as indicated on the drawings.**

Rating: 150 psig @ 200°F

Sizes and Mfr: 1" thru 20", Uniroyal 6150, or equal

- 31.06 Flexible rubber pipe with black rubber outer cover, multi-ply carcass construction with helical body wire, rubber tube, integral built-up duck and rubber full faced flanges with 150 lb. ANSI B16.5 drilling. End-to-end length to be as indicated on the drawings.**

Rating: 250 psig @ 200°F

Sizes and Mfr: 1" thru 20", Uniroyal 6250, or equal

- 31.07 Rubber water hose with abrasion resistant synthetic rubber outer cover, synthetic fiber braided carcass, and special rubber stock inner tube. Hose to have brass long shank male NPT end fittings.**

Rating: 150 psig @ 200°F

Sizes and Mfr: 1/2" thru 1 1/4", Uniroyal P-340, or equal

- 31.08 Flexible rubber hose to convey syrup and granular carbon slurry, and granular carbon and water slurry, at a maximum temperature of 160°F and maximum pressure of 100 psig. End-to-end length and type of connectors to be as indicated on drawings. Hose shall be abrasion resistant and shall meet Federal Drug Administration requirements. Gates 32W, or equal.**

Sizes: 2" to 4"

- 31.22 Rubber water hose with black synthetic rubber cover with special blue identification strip, cotton interwoven with spring steel wire carcass, seamless rubber tube. Hose to have brass male NPT fitting on one end and bronze quick disconnect conflex Item 32.18. Length per Bill of Material.**

Uniroyal P-5107 or equal.

Rating: 100 psi minimum

Sizes: 1 1/4" I.D. to 4" I.D.

PIPING SPECIALTIES SPECIFICATION 32

HOSE FITTING

- 32.01 Quick disconnect adapter, cast iron, female NPT on one end with other end for connecting to quick disconnect coupler. OPW Division of Dover Corp., Kamlok Part No. 633-A, or equal.

Rating: 75 psig to 250 psig @ 225°F depending on size

Sizes: 1/2" thru 6"

- 32.02 Quick disconnect coupler, cast iron, Buna-N gaskets, female NPT on one end with other end for connecting to quick disconnect adapter. OPW Division of Dover Corp., Kamlok Part No. 633-D, or equal.

Rating: 75 psig to 250 psig @ 225°F depending on size

Sizes: 1/2" thru 6"

- 32.03 Quick disconnect adapter, bronze, male NPT on one end with other end for connecting to quick disconnect coupler. OPW Division of Dover Corp., Kamlok Part No. 633-F, or equal.

Rating: 75 psig to 250 psig @ 225°F depending on size

Sizes: 1/2" thru 6"

- 32.04 Quick disconnect coupler, bronze, Buna-N gaskets, female NPT on one end with other end for connecting to quick disconnect adapter. OPW Division of Dover Corp., Kamlok Part No. 633-D, or equal.

Rating: 75 psig to 250 psig @ 225°F depending on size

Sizes: 1/2" thru 6"

- 32.05 Quick disconnect adaptor, 150 lb. ANSI flange, carbon steel construction. Kamlok 633-LAS, or equal.

Rating: 100 psig @ 225°F

Sizes: 1" thru 4"

HOSE FITTINGS (Cont'd)

- 32.06 Quick disconnect adaptor, cast iron, male NPT on one end with other end for connecting to quick disconnect coupler. Kamlock 633-F, or equal.**

Rating: 100 psig @ 225°F

Size: 1½" thru 4"

- 32.07 Quick disconnect adaptor, 150 lb. ANSI flange, bronze construction. Kamlock 633-LAS, or equal.**

Rating: 150 psig @ 225°F

Size: 1" thru 4"

- 32.08 Quick disconnect coupler; 150 lb. ANSI flange, bronze construction. Kamlock 633-LBS, or equal.**

Rating: 100 psig @ 225°F

Size: 1" thru 4"

- 32.09 Quick disconnect coupler, bronze, Buna-N gaskets, male NPT on one end with other end for connecting to quick disconnect adapter. OPW Division of Dover Corp., Kamlok Part No. 633-B, or equal.**

Rating: 75 psig to 250 psig @ 225°F depending on size

Size: 1/2" thru 6"

- 32.10 Quick disconnect adapter, bronze, female NPT on one end with other end for connecting to quick disconnect coupler. OPW Division of Dover Corp., Kamlok Part No. 633-A, or equal.**

Rating: 75 psig to 250 psig @ 225°F depending on size

Size: 1/2" thru 6"

- 32.11 Quick disconnect coupler, stain, steel, Buna-N gaskets, female NPT on one end, other end for connecting to quick disconnect adapter. OPW Division of Dover Corp., Kamlok Part No. 633-D, or equal.**

Rating: 75 psig to 250 psig @ 225°F depending on size

Size: 1/2" thru 6"

PIPING SPECIALTIES SPECIFICATION 35

PLASTIC SPACERS FOR POLYPROPYLENE LINED PIPE

The spacers listed below for plastic lined pipe shall be fabricated from thermally stabilized polypropylene resin suitable for minus 20° to plus 225°F service. Spacers shall be molded or machined in accordance with Calgon Drawing No. 7209A-561.

Sizes: 1" through 8", unless otherwise stated

- | | |
|-------|---|
| 35.01 | Standard ring spacer |
| 35.07 | Standard ring blind spacer |
| 35.13 | Standard full face spacer |
| 35.19 | Standard full face blind spacer |
| 35.25 | Special tapered bore ring spacer |
| 35.31 | Single taper ring spacer with 4° - 9' taper - for 4" line only. |
| 35.37 | |
| 35.43 | Orifice spacer, ring type/one 3/4" FNPT tap |
| 35.49 | Orifice spacer, ring type/one 1/2" FNPT tap |
| 35.55 | Orifice spacer, ring type/two 3/4" FNPT taps @ 180° |
| 35.61 | Orifice spacer, ring type/two 3/4" FNPT taps @ 90° |
| 35.67 | Orifice spacer, ring type/one 1/2" and one 3/4" FNPT tap @ 180° |
| 35.73 | Orifice spacer, ring type/one 1/2" and one 3/4" FNPT tap @ 90° |
| 35.79 | Orifice spacer, ring type/one 1 1/2" FNPT tap. |
| 35.85 | Orifice spacer, ring type/one 3/4" and one 1 1/2" FNPT tap @ 180° |
| | |
| 35.98 | Special Flush/Drain Screen Spacer/one 3/4" and one 1" FNPT tap for 4" size line only. |
| 35.99 | Special Flush/Drain Screen Spacer/one 1 1/2" and one 2" FNPT tap for 4" size line only. |

TEMPERATURE INDICATORS

MANUFACTURER & MODEL: Ashcroft Model AHT, or equal

TYPE: Bi-Metal dial thermometer and thermowell without lagging extension

FORM: Back connected

HEAD

Size: 5" diameter

Material: Type 304 stainless steel case and bezel

RANGE: See below

DIAL: Laminated plastic with white face and black markings

STEM

Material: Type 304 stainless steel

Connection: 1/2" NPT

Diameter: 1/4 inch

Length: 6 inch ("S")

THERMOWELL

Construction: Solid bored

Material: Type 304 stainless steel

Equipment Connection: 3/4" NPT

Dimensions

Length under Thread: 4 1/4" ("U")

Overall Length: 6 1/4" ("L")

Lagging Extension: None

TAGGING: Tag all items with Item No. and Service

ITEM NUMBER **RANGE**

TI-131 0-200°F

Weksler AA44P-Liquid Fill

Glycerin (Temp. range of -36°F to +140°F)

Tag each assembly with Item No. and Service

SERVICE

0-200 psig

PI-112 " " "

Ashcroft
Ametek-U.S. Gauge
Marshalltown

ITEM NO.	FQI-600
NO. REQ'D	Three (3)
MANUFACTURER	Signet Scientific Company
TYPE	Paddlewheel, electronic Indicating-Totalizer
SENSOR	Signet MK-515-P1, Standard Flosensor, for installation in an 8" schedule 40 steel pipe.
RATING	200 Psig @ Ambient Temp.
SCALE RANGE	0-1800 GPM
INSTALLATION FITTING	Signet Model CS4W080, Weldolet for MK515 Sensor, Carbon Steel, Schedule 40 Pipe.
CABLE	25 lineal ft. standard cable with each Sensor.
INDICATOR-TOTALIZER	Signet MK575 analog flowmeter, with 5½" diam., 0-1800 GPM indicator dial, with 7-digit non-resettable counter, and 117Vac/12Vdc converter.
MOUNTING	NEMA 12 housing for 3 instruments, 14" x 16" x 6" dp. Signet Part No. 500.50.3
SERVICE	To measure , indicate and totalize flow of water containing not more than 1% solids

ITEM NO.	PCV-601
NO. REQUIRED	See Bill of Material
MANUFACTURER	Jordan Valve Division,
TYPE	Self-operated, Sliding Gate Type, Pressure Regulator, Jordan Series 600, Downstream Pressure under the Diaphragm, Screw-adjusted Spring for Pressure Set Point.
BODY	Bronze, Threaded Ends,
SIZE	2" NPT
TRIM	Type 303 Stainless Steel Seats, Bronze Pressure Ring, 303 Stainless Steel Disc Pin and Stem.
DIAPHRAGM	Stainless Steel,
SERVICE CONDITIONS	
Fluid	Water
Fluid Temperature	Ambient
Upstream Pressure	45 Psig Minimum, 150 Psig Maximum.
Downstream Pressure	20 Psig
Flow Rate	200 Gpm
Cv	50
Control Range	6 -30 Psig.

ITEM NO.	FCV-603
NO. REQ'D	One (1)
MANUFACTURER	Crane Co., or equal
TYPE	Lug wafer type butterfly valve with electric motor actuator, all per AWWA Spec. C-504.
SIZE	12" diam., to fit between 12", 125# F-F flanges.
FLUID	Water @ ambient temperature.
DIFFERENTIAL PRESSURE	50 psig. max.
VALVE	
Body	Ductile cast iron, lug type, with threaded bolt holes.
Liner	Buna-N
Disc	Cast iron with ground and polished edge..
Stem	One piece, full AWWA dia for entire length.
Bearings	Reinforced Teflon
ACTUATOR	120 Vac, 60 Hz, single phase, reversible electric motor, NEMA 4 enclosure, with disengageable manual override.

ITEM NO.	PSE-602
NO. REQUIRED	See Bill of Material
MANUFACTURER	Carborundum Co., Zook, Carbone or Frangible Discs
TYPE	Impervious Graphite, to Fit between 150# ANSI RF or FF Companion Flanges Furnished by Others.
SERVICE CONDITIONS	
Location	On ASME Pressure Vessel
Vessel Design Pressure	150 PSIG
Fluid	Well Water
Temperature	50-60 deg. F
Operating Pressure	50 PSIG, Normal
Back Pressure	Atmospheric
Bursting Pressure	150 PSIG \pm 5 %
Relieving Capacity	Nil, for Thermal Expansion only
NAMEPLATE	In Accordance with ASME Requirements

SECTION IV

Subcontractor Vendor List



Witcher Construction Company
General Contractors

SUBCONTRACTOR/VENDOR LIST

Calgon Water Treatment Facility
2935 Jersey, St. Louis Park, MN 55416
Project Manager: Dennis McEvoy
Project Superintendent: Marv Bartz

Job # 8515

<u>SECTION NO.</u>	<u>DESCRIPTION</u>	<u>SUBCONTRACTOR/VENDOR</u>	<u>TYPE</u>	<u>CONTACT</u>	<u>PHONE</u>
01000	General Conditions	Witcher Construction Co.	S	Dennis McEvoy	544-2727
02100	Site Clearing	Imperial Developers	S		
02200	Earthwork	Imperial Developers 9001 Grand Avenue S. Bloomington, MN 55420	S	Marty	881-6464
02240	Blacktop	Minnesota Roadways 229 W. 79th St. P. O. Box 279 Chanhassen, MN 55317	S	Dick Wronski	934-0296
02801	Sod	Glenn Rehbein Excavating Inc. 7309 Lake Drive Lino Lakes, MN 55038	M		784-0657
02800	Landscaping	Mike Winge Landscaping Inc. 13784 Lake Drive Forest Lake, MN 55025	S	Mike Winge	464-5222
03200	Concrete Reinf.	Rebarfab, Inc. 720 1st Street S.W. P.O. Box 12267 New Brighton, MN 55112	M	Lyman Spargus	633-3337
03200	Rebar Replace. (Labor Only)	Danny's Construction 3549 Eagle Creek Rd. Shakopee, MN 55379	S	Larry Wilson	445-4143
03300	Cast-i-p Concrete	Witcher Construction Co.	S	Dennis McEvoy	544-2727

SUBCONTRACTOR/VENDOR LIST (Job # 8515)

Calgon Water Treatment Facility

Page 2

<u>SECTION NO.</u>	<u>DESCRIPTION</u>	<u>SUBCONTRACTOR/VENDOR</u>	<u>TYPE</u>	<u>CONTACT</u>	<u>PHONE</u>
03420	Precast Concrete	Spancrete Midwest Box AA, Highway 152 Osseo, MN 55369	S	Steve Bush	425-5555
04200	Masonry Brick Only	Midwest Brick & Supply Co. P. O. Box 26528 St. Louis Park, MN 55426	M		929-0321
04200	Unit Masonry	Serice Construction 7109 Cahill Avenue East Inver Grove Heights, MN 55075	S	Sanny Anderson	451-9310
05500	Misc. Metal	Anderson Iron Works Inc. 5335 N. County Rd. 18 Minneapolis, MN 55428	M	Dick Grover	559-4533
06100	Rough Carpentry	Witcher Construction Co.	S		544-2727
07500	Membrane Roofing	Curran V. Nielsen 6600 Oxford Street Minneapolis, MN 55426	S	Dennis Rosenquist	925-3222
07600	Sheet Metal	Curran V. Nielsen	S		925-3222
07900	Caulking	Carciofini Caulking 3216 N. Rice St. St. Paul, MN 55112	S	Ron Carciofini	483-4618
08110	Hollow Metal Doors & Frames	Gardner Hardware 515 Washington Ave. N. Minneapolis, MN 55401	M	Ray Alstadt	333-3393
08360	Overhead Door	Crawford Door Co. 1641 Oakdale Ave. West St. Paul, MN 55118	S	Clark Lindstrom	455-1221

SUBCONTRACTOR/VENDOR LIST (Job # 8515)
 Calgon Water Treatment Facility
 Page 3

<u>SECTION NO.</u>	<u>DESCRIPTION</u>	<u>SUBCONTRACTOR/VENDOR</u>	<u>TYPE</u>	<u>CONTACT</u>	<u>PHONE</u>
08700	Finish Hardware	Gardner Hardware	M	Ray Alstadt	333-3393
08850	Glass & Glazing	Heat Miser Bradford & Hwy. 47 P. O. Box 338 Isanti, MN 55040	S	John Wojak	444-9234
09330	Quarry Tile	Twin City Tile & Marble Co. 219 E. Island Avenue Minneapolis, MN 55401	S		379-2825
09900	Painting	Prindle Painting Co. R. R. 1, Box 82 Loretto, MN 55357	S	Dennis Prindle	478-9785
15000	Mechanical	NewMech Companies 1633 Eustis Street St. Paul, MN 55108	S	Eddie King/ Phil O'Brien	642-3532
16000	Electrical	Spencer Electric 550 S. Willow Drive Long Lake, MN 55356	S	Steve Kaster	476-1211
16000	Electrical - Temp Hookups, Pole Removal	Parsons Electric 917 5th Avenue S. Minneapolis, MN 55404	S		339-8761

SECTION V

Miscellaneous Equipment Manuals

MISCELLANEOUS EQUIPMENT MANUALS

LISTING

1. CRANE DEMING PUMP
2. WILKINS BACKFLOW PREVENTER
3. WATTS BACKFLOW PREVENTER
4. LCN DOOR CLOSER
5. TRANE FURNACE
6. GOLDLINE CONTROL
7. SIGNET FLOW METER
8. WITCHER VENDOR INFORMATION
9. KEENE LUMINAIRES
10. CARLISLE ROOF
11. SURE-LITE EXIT SIGN
12. DUAL LITE EMERGENCY LITE

4001
4011
4021
4031

INSTRUCTIONS

INSTALLATION

and CARE

of DEMING

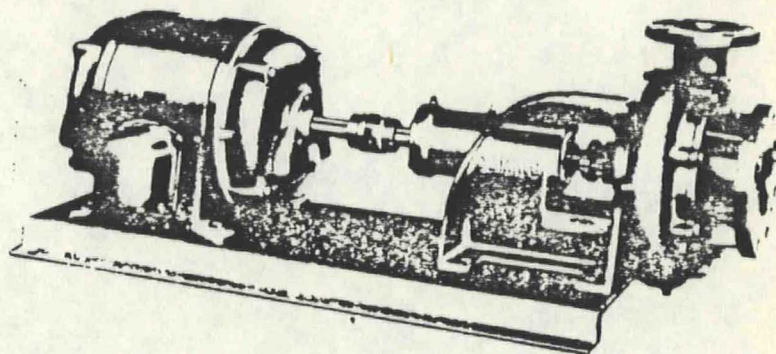
END SUCTION

DOUBLE

BEARING

CENTRIFUGAL

PUMPS



CRANE

(H)

VALVES • PUMPS • FITTINGS • WATER TREATMENT •

• CONTROLS • PLUMBING • HEATING

DEMING PUMPS

Form 287R

CRANE CO. • 884 South Broadway, Salem, Ohio 44460

IMPORTANT

Motor driven pumps are carefully aligned on sub-base before shipment. However, after they are placed upon the foundation, and sub-base is bolted down, the alignment must be rechecked and in **MOST CASES** it will be found necessary to carefully realign the unit. Quite often a noisy pump is due to pump and motor not being properly aligned. **IN SUCH CASES WE DISCLAIM ALL RESPONSIBILITY FOR PROPER WORKING OF THE PUMP.**

Pumps are normally furnished with standard stuffing box construction as shown on page 5. Flushing type stuffing box, shown on page 5, or mechanical shaft seal, page 5 and 6, can be furnished in lieu of standard stuffing box.

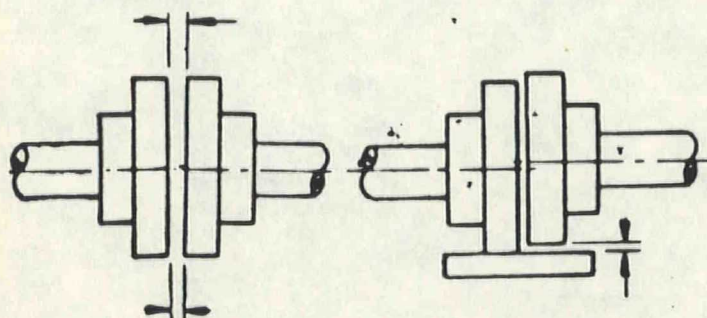
The single shaft seal (page 5) is used for handling clear liquids at temperatures below their boiling point or 212° F as recommended by the seal manufacturer. A portion of this liquid is by-passed into the seal chamber through the by-pass tube (33) to serve as a lubricant and as a coolant. The by-pass from the pump discharge must be a minimum of 20 pounds pressure above the suction pressure of the pump to insure proper operation of the seal.

The double shaft seal (page 6) is used when pumping abrasive or non-lubricating liquids or liquids of excessive temperature. If the discharge pressure ever exceeds 25 pounds, a sealing liquid at 15 to 20 pounds higher than maximum discharge pressure must be circulated through the seal chamber. Clear water under such pressure can be used in most applications as a sealing liquid for lubrication and cooling.

If the discharge pressure is constantly under 25 pounds and the temperature is less than the boiling point of the liquid being pumped or 212° F, the seal chamber can be filled with a quality light weight ball bearing grease. A spring-loaded compression type grease cup should be installed to maintain pressure in the seal chamber.

A. INSTALLATION

1. A good rigid foundation must be provided for the pump base.



WRONG

Horizontal Misalignment

WRONG

Vertical Misalignment

2. Place pumping unit on foundation with bolts in place and with metal wedges under the sub-base to give a space of about $\frac{3}{4}$ " for grouting. Bring sub-base approximately level.
3. Align the pump and motor shafts at the flexible coupling. Hold a straight edge on the top of the coupling so that it extends over both halves. Straight edge should rest evenly across both rims of the

coupling halves when the straight edge is placed on the top, sides and the bottom with no light showing between the straight edge and the rim of the coupling. Also check vertical alignment of the coupling faces with a thickness gauge. Faces must be parallel and spaced about $\frac{1}{4}$ " apart when the motor rotor is at its extreme position towards the pump. This safeguards the pump shaft being crowded endwise by the motor shaft end play. By proper adjustment of metal shims under pump or motor, both halves of the flexible coupling can be brought into alignment.

4. Build a dam around sub-base at least 2" high for grouting in with thin cement and after cement has hardened, tighten anchor bolts.
5. Recheck alignment at drive coupling. Any misalignment now apparent should be corrected by metal shims under pump or motor. When properly aligned, pump shaft should turn freely by hand.
6. A foot valve and strainer must be installed on the lower end of the suction pipe to keep pump completely filled with liquid when the pump is used under suction lift conditions. Connect suction pipe to pump casing.

When a foot valve is used, it is **absolutely necessary** to install a check valve in the discharge line near the pump to prevent possible broken casing due to line shock or surge when the pump stops. A gate valve should also be installed in the discharge line. Connect discharge pipe to pump casing.

It is very important that the suction and discharge pipes "line up" naturally with the pump. Do not "pull" pipes into position with flange bolts. Support pipes independently of the pump to eliminate all strain on the pump casing.

Select discharge pipe size so velocity is under 8 feet per second. Avoid sharp changes in pipe sizes.

7. After pipes have been connected to pump, check alignment at drive coupling. Correct any changes with metal shims as in section "A".
8. Check motor nameplate for electrical characteristics. Be sure they are the same as the rating of the electric power available. Connect power lines to motor in accord with wiring diagram on the motor and test motor rotation; should turn in the direction indicated by arrow cast on pump casing.
9. Fill pump (and suction pipe) with water. Remove plug (49) at top of casing (45) to relieve trapped air then replace plug. Close discharge gate valve and start pump. When pump is up to speed, slowly open the discharge valve to obtain desired capacity and pressure.

B. LUBRICATION

1. Pump bearings are properly filled with grease at the factory before shipment. Periods of subsequent lubrication depend somewhat on local conditions—loads, speed, hours of operation, temperature, etc. Periodic inspection of bearing lubrication should be made and additional grease added as needed thru grease fittings (3) on the pump. A No. 2 grease (soft) is recommended for most installations. Do not over grease as this causes high bearing temperatures and shortens bearing life.

2. Motor bearings should also have periodic attention and lubrication in accord with motor manufacturers recommendations.
Under ordinary conditions a ball bearing will run from 10° to 60° Fahrenheit above surrounding temperatures. Unless bearing temperature runs extremely hot do not become alarmed.
3. On standard-fitted, bronze-fitted and all-bronze construction, the stuffing box is lubricated by liquid being pumped, thru a by-pass tube. On all-iron construction, the by-pass tube is eliminated and a grease fitting installed for stuffing box lubrication. A "water pump" grease is recommended.
If the liquid being pumped is abrasive, a fresh water supply should be connected to the stuffing box instead of the grease fitting (30) or tubing (33).
4. Single seals normally do not require grease lubrication as they are lubricated and cooled by the liquid returned to the seal chamber thru the by-pass tube.
5. Double seals should be cooled and lubricated by a sealing liquid under pressure, such as clear water. If the pressure at the inner face of the seal is constantly under 25 PSI and the liquid temperature is under the boiling point, or 212° F, a spring-loaded compression type grease cup, filled with Standard Artic No. "O" grease or equal, may be used if suitable sealing liquid is not available.

GENERAL MAINTENANCE AND REPAIRS

C. PROPER ADJUSTMENT OF IMPELLER

1. Loosen adjusting nut clip (10) by unscrewing cap screw (11) then turn bearing adjusting nut (8) counter-clockwise to allow the impeller (47) to just touch the suction head face (46). It may be necessary to bump the shaft (15) on coupling end to make sure the bearing (20) is against the bearing adjusting nut (8). Then back off the impeller slightly by tightening the bearing adjusting nut in a clockwise direction. Rotate the shaft by hand to make certain that the impeller does not rub against the suction head face. Lock the bearing adjusting nut in place with the bearing adjusting nut clip (10) and cap screw (11).
2. One of the outstanding features of this pump is the impeller axial adjustment for wear or capacity. Less water, head, or horsepower, may be achieved by turning the bearing adjusting nut (8) in a clockwise direction. This moves the impeller away from the suction head face. If maximum head or capacity are required, move the impeller as close as possible to the suction head face without allowing it to rub.
An extremely accurate adjustment may be made by adjusting the impeller while in operation and checking the motor with a watt-meter. After final adjustment of impeller is made, lock the bearing adjusting nut in place with adjusting nut clip and tighten cap screw. This adjustment should not be changed until the impeller face is worn enough to warrant re-adjustment.

D. PROPER ADJUSTMENT OF STUFFING BOX

The liquid being pumped should constantly, yet slowly, drip from the stuffing box gland (26) when the pump is running. This slow drip keeps the shaft from becoming scored. NEVER tighten the gland so as to entirely stop leakage through stuffing box. It

increases the power and wears the shaft in a short time.

2. The stuffing box gland (26) can be taken apart. This facilitates repacking the stuffing box. Access to the packing (24) is obtained by removing the nuts from bolts (27) which fasten the stuffing box gland to the stuffing box head. Clean out the drip holes in the gland occasionally as they may become clogged, especially with new packing. The drip hole allows the sealing liquid to drip thru the gland, instead of passing between the gland and the shaft.
3. Standard pumps are equipped with a circulation tube (33) from discharge to the stuffing box lantern ring so that the pump will not suck air in along the shaft when the pump is operating on a suction lift. If the pump is to operate with positive suction head, disconnect this tube, plug the holes concerned and run the pump with the stuffing box gland as loose as possible to avoid excessive shaft wear through the stuffing box.

E. GENERAL REPAIRS

Whenever it is necessary to dismantle the pump for repairs, it should be removed from the sub-base. Disconnect the suction and discharge pipes and remove the four cap screws holding pump to sub-base. Drain pump by removing drain plug (49) in the bottom of the pump casing (45).

CLEAN AND INSPECT ALL PARTS

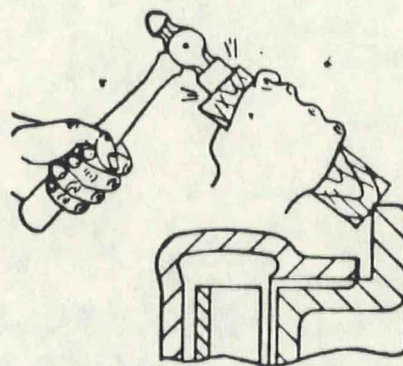
Extreme care should be exercised in keeping the parts clean. Special precautions should be taken to keep ball bearings dirt-free while in or out of the pump. The dirt will damage the ball bearings, thus shortening the trouble-free service life of the pump.

Any part which is excessively worn or deteriorated should be replaced with new parts from factory.

When ordering repairs refer to the illustrations for part names and the pump name plate (37) on which is stamped the figure number, size and serial number. Without this information we cannot identify the pump and parts in question.

F. FOR INSPECTION AND REPAIR OF LIQUID END

1. Remove suction head cap screws (39), then set a block of wood against the finished flange or back of the suction head (46) and tap block lightly with a hammer to loosen suction head. Remove suction head from pump and place suction head gasket (48) in a bucket of water to keep it soft and pliable.



2. Bend and remove cotter pin (64) in castellated nut (16).
3. Unscrew the castellated nut (16) by turning counter-clockwise while holding shaft with a wrench at drive coupling. Then slide the impeller washer (19) off the shaft.
4. To remove the impeller (47) from the shaft, make 3 special cap screws as follows; Fig. 4001 - 3/8" x 16

NC with thread cut 1 1/4" long; Fig. 4011 and 4021 - 1/2" x 13 N.C. with thread cut 2" long; and Fig. 4031 - 3/4" x 10 N.C. with thread cut 2 1/4" long. Screw these cap screws into the three tapped holes in the impeller shroud. The cap screws will tighten against the stuffing box head (23), thus forcing the impeller from the shaft. Lift the impeller key (18) from its seat in the shaft.

5. To remove the pump casing (45), first disconnect by-pass tube (33) from the casing then remove casing cap screws (2), casing and stuffing box gasket (29) will lift off the support head (1). Place gasket in water.
6. The stuffing box head can be removed after loosening gland bolts and nuts (27-28).

G. To INSPECT OR REPLACE BALL BEARINGS OR SHAFT

1. Dismantle liquid end of pump as described in Section F then loosen set screws in pump half of drive coupling and remove coupling from pump shaft. Also remove key (17) from shaft.
2. Unscrew bearing cover cap screws (6) and remove bearing cover (4), gasket (5) and bearing adjusting spring (7). Place gasket in water. Pull the pump shaft (15) out thru the coupling end of the support head (1). Slinger (14) will drop into support head drip basin. Be careful not to lose it.
3. By inspection, determine whether it is necessary to replace the ball bearings (20) and (21). If so, press on inner race of the shielded side of the bearing and not against the outer race of the bearing or the shaft shoulder. Bearing collars (22) will press off with the bearing.

H. REASSEMBLING OF SHAFT AND BEARINGS

1. To replace bearings, slide bearing (21) over the coupling end of the shaft (shielded side first) until the inner race is tight against the shaft shoulder. Press locking collar (22) into position against the bearings. Then slide bearing (20) onto the tapered end of the shaft, shielded side first, until the inner race is tight against shaft collar. Replace locking collar (22). Apply fresh grease, of the proper grade, between the races of each bearing. Also fill bearing housings in the support head about 1/4 full of grease. Never use any of the old grease.
2. Inspect felt ring (9) in the bearing cover (4) and in the bearing adjusting nut (8). To replace felt rings remove clamping rings (13) and insert new felt rings. Press clamping rings into position.
3. Insert shaft (15) into support head, from the coupling end, tapered end first. When shaft starts thru bearing adjusting nut (8), place slinger (14) over the end of the shaft. Push shaft thru support head until bearing is tight against the bearing adjusting nut. Place bearing adjusting spring (7) over coupling end of shaft and place bearings cover gasket (5) on bearing cover. Slide bearing cover over end of shaft and push against end of support head compressing bearing adjusting spring sufficiently to replace bearing cover cap screws (6). Tighten cap screws securely. Place shaft key (17) in keyway on end of pump shaft and press pump half of drive coupling onto shaft. Tighten set screws.

I. REASSEMBLY OF LIQUID END

1. If stuffing box head (23) was removed, place stuffing box head over shaft in manner shown with slots for bolts and nuts on the horizontal centerline when the holes in the flange of the stuffing box head are in line with those of the support head (1).
2. Insert casing cap screws (2) thru holes in support head and stuffing box head and position stuffing box gasket (29) on the stuffing box head. Place casing (45) on the support head with discharge in the desired position. Tighten casing cap screws securely. Connect by-pass tubing (33) to casing.
3. Seat impeller key (18) in shaft keyway and place impeller (47) on shaft with keyway over impeller key. Place a wooden block over impeller vanes and tap on wood to seat impeller on the shaft taper. Replace impeller washer (19) on the shaft and then the castellated nut (16). Tighten nut securely. **DO NOT USE IMPELLER NUT TO DRAW IMPELLER ONTO SHAFT. NUT IS A LOCKING DEVICE ONLY.**
- 3.5 Replace cotter pin (64) in castellated nut
4. Position suction head gasket (48) on suction head (46) and replace suction head on the casing. Fasten in place with suction head cap screws (39).
5. Replace gland bolts and nuts (27-28) and tighten "finger tight." Check impeller adjustment per Section C and replace bearing adjusting nut clip (10) and screw (11). See Section D for proper stuffing box adjustment.

J. REPACKING STANDARD STUFFING BOX

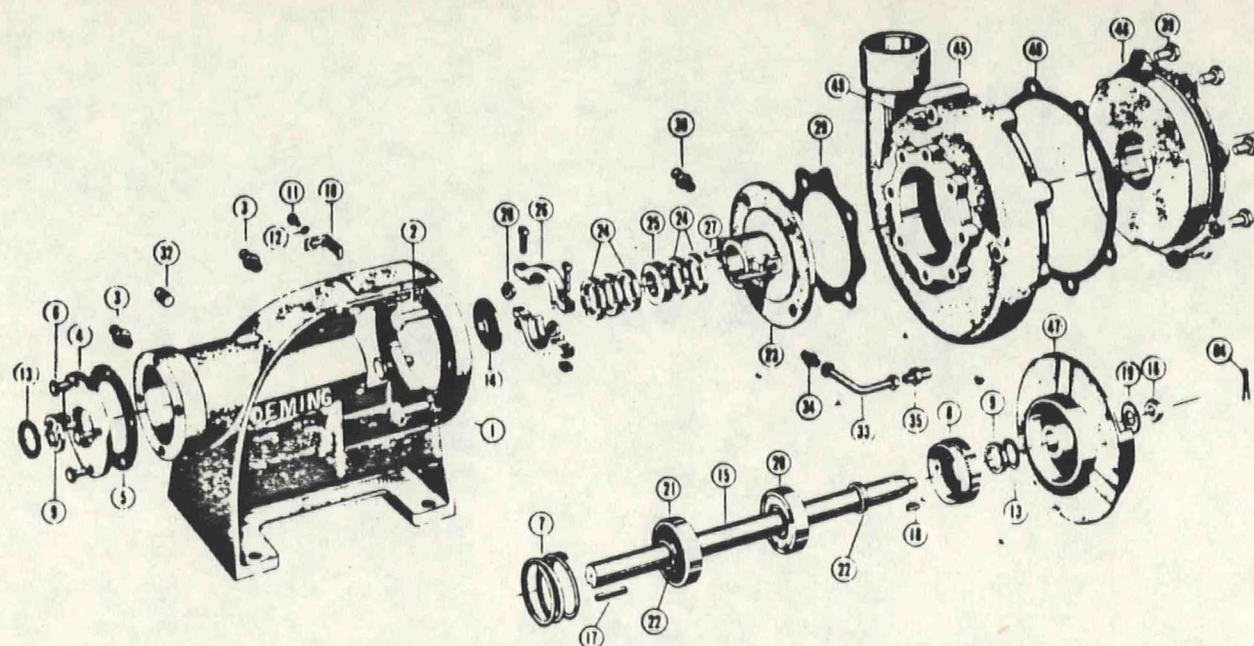
1. Remove stuffing box bolts and nuts (27-28) also gland bolts and nuts and remove gland from shaft. With a packing puller, remove the old packing (24) and lantern ring (25) from the stuffing box head (23).
2. Make sure that the correct packing is used for liquid being pumped.
3. Cut five rings of packing so that when wrapped around the shaft, the ends do not quite touch.
4. Tamp first ring into stuffing box, then turn shaft over by hand.
5. Stagger the next packing ring joint so that the joints will be 180° apart. Seat ring evenly and tamp into place. Turn shaft again by hand.
6. Place lantern ring (25) in next.
7. Position and seat the next three rings of packing separately, staggering the joints 180° apart. Tamp into place.
8. Replace stuffing box gland, (26) fastening the two halves together with gland bolts and nuts. Replace and tighten stuffing box bolts and nuts (27-28), then loosen nuts until shaft can be turned freely by hand. See Section D for proper adjustment.

K. REPACKING FLUSHING TYPE STUFFING BOX

The flushing type stuffing box construction is ideal for shaft cooling or high vacuum sealing. For abrasive or corrosive liquids, a pressurized clear water connection to the stuffing box is recommended. A drain hole is provided for piping flushing liquid to drain.

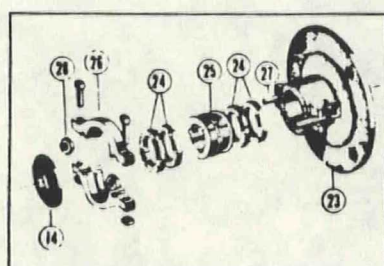
1. Repacking procedure is same as above except that only four rings of packing (24) are required and the standard lantern ring is replaced by the stuffing box bushing (25).

Fig. 4001-4011-4021-4031 End Suction Centrifugal Pump



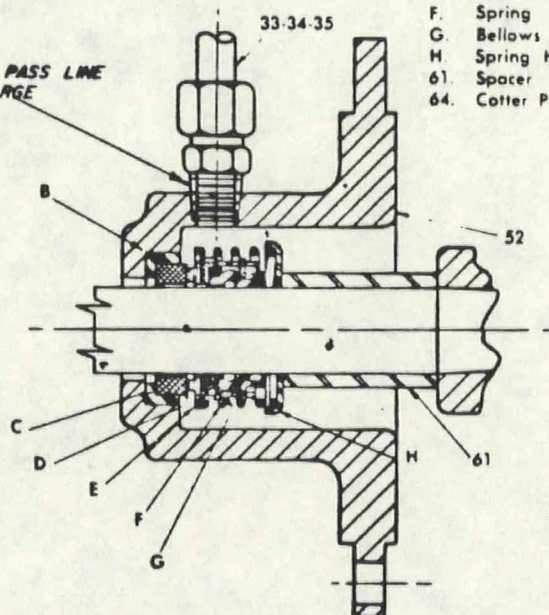
NO.	PART	NO.	PART	NO.	PART	NO.	PART
1.	Support Head	11.	Cap Screws (Adjusting Nut Clip)	21.	Ball Bearing (Coupling End)	32.	Pipe Plug
2.	Cap Screws (Casing)	12.	Lock Washer (Adjusting Nut Clip)	22.	Bearing Collar	33. 34. 35.	Tubing & Connector
3.	Grease Fittings	13.	Clamping Ring	23.	Stuffing Box Head	39.	Cap Screws (Suction Head)
4.	Bearing Cover	14.	Slinger	24.	Stuffing Box Packing	45.	Casing
5.	Gasket (Bearing Cover)	15.	Shaft	25.	Lantern Ring	46.	Suction Head
6.	Cap Screws (Bearing Cover)	16.	Castellated Nut	26.	Stuffing Box Gland	47.	Impeller
7.	Bearing Adjusting Spring	17.	Shaft Key, Square	27.	Bolts	48.	Gasket Suction Head
8.	Bearing Adjusting Nut	18.	Impeller Key, Woodruff	28.	Nuts (Gland)	49.	Pipe Plugs (Liquid End)
9.	Felt Ring	19.	Impeller Washer	29.	Gasket (Stuffing Box Head)	52.	Seal Head
10.	Adjusting Nut Clip	20.	Ball Bearing (Stuffing Box End)	30.	Grease Fitting (All Iron)	B.	Seat Gasket

FLUSHING TYPE STUFFING BOX



- 14. Slinger
- 23. Stuffing Box Head
- 24. Stuffing Box Packing
- 25. Stuffing Box Bushing
- 26. Stuffing Box Gland
- 27. Bolts (Gland)
- 28. Nuts (Gland)

1" - 18 N.P.T. BY PASS LINE FROM DISCHARGE



L. TO REPLACE SINGLE MECHANICAL SEAL

NOTE: Seals are available as a complete assembly only.

1. Special precautions must be observed when handling a mechanical seal. Do not drop the seal face car-

bons, or floating seats, nor scratch the lapped faces of these parts.

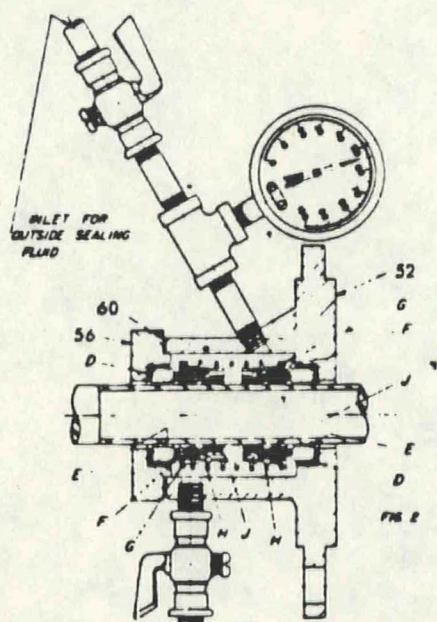
2. To remove the seal assembly, dismantle the liquid end of the pump as described in Section F. After removing the casing, the seal head assembly may be removed from the support head. Press the seat gasket (B) and floating seat (C) from the seal head (52).

3. To install new seal assembly, oil the outer surface of the seat gasket (B) and press seat gasket and floating seat assembly (B and C) into the seal head cavity. DO NOT SCRATCH FACE OF FLOATING SEAT. Wipe seat with clean light oil.
4. Apply a thin coating of clean light oil (not grease) to the shaft and reposition seal head(52) on the support head. Also apply a thin coating of light oil to the inside of the seal bellows, wipe face of seal face carbon (D) with light oil, then slide the seal face carbon, bellows (G), retainer (E), spring (F), spring holder (H) and spacer(61) onto the shaft.
NOTE: It may be necessary to use a piece of tubing, slightly larger than the shaft, to push the bellows and retainer onto the shaft. Apply pressure only on the "tail section" of the bellows and retainer.
5. Insert casing cap screws (2) through holes in support head and seal head and position gasket (29) on seal head. Complete assembly of liquid end as described in Section I.

M. TO REPLACE DOUBLE MECHANICAL SEAL

NOTE: Seals are available as a complete assembly only.

1. Special precautions must be observed when handling a mechanical seal. Do not drop the seal face carbons or floating seats nor scratch the lapped faces for these pieces.

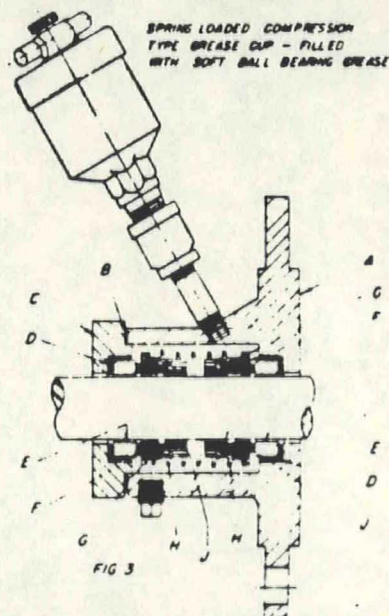


52 Seal Head
60 Gasket (Seal Gland)
C. Seal Gland
D. Seal Gasket

E. Floating Seat
F. Seal Face Carbon
G. Retainer
H. Spring
J. Bellows

2. To remove the seal assembly, dismantle the liquid end of the pump as described in Section F, then un-

screw gland bolts and nuts (27-28). Remove seal head casting (52) from the support head, exposing the seal assembly. Grasp the seal firmly by hand and twist it on the shaft to break the seal between the bellows and the shaft. The seal can now be pulled from the shaft. Also remove the seal gland (56) from the shaft. Place gland gasket (60) in water. Press seat gaskets (D) and floating seat (E) from the seal gland (56) and seal head (52).



3. To install new seal assembly, oil the outer surface of seat gasket (D) and press seat gasket and floating seat assembly (D and E) into the seal gland cavity. Also apply oil to the outer surface of seat gasket and press seat gasket and floating seat assembly into the cavity in the base of the seal head (52). DO NOT SCRATCH FACE OF FLOATING SEATS.

4. Apply a thin coating of light oil (not grease) to the shaft and inside of bellows then slide the seal gland assembly (56) onto the shaft, followed by the gland gasket (60), then the seal face carbon (F), with retainer (G) and bellows (J). (It may be necessary to use a piece of tubing, slightly larger than the shaft, to push the bellows and retainer onto the shaft. Apply pressure only on the "tail section" of the bellows and retainer.) Next, place the spring (H) over the first section of the seal already on the shaft; then, slide the second bellows, retainer and seal face carbon onto the shaft.

5. Carefully wipe the lapped faces of the two floating seats (E) and the seal face carbons (F) to remove any foreign matter from the surface and oil all four faces. Next, place the seal head (52) over the shaft with slots for bolts and nuts (27-28) on the horizontal centerline with the holes in the flange of the seal head are in line with those of the support head. Insert casing cap screws (2) through holes in the support head and seal head and position gasket (29) on seal head. Complete assembly of liquid end as described in Section I.

LOCATING TROUBLE

1. No Water Delivered.
 - a. Pump not primed.
 - b. Speed too low (check with revolution counter).
 - c. Discharge head too high.
 - d. Suction lift too high, over 15 feet (check with vacuum gauge.)
 - e. Impeller completely plugged.
 - f. Wrong direction of rotation.
2. Not Enough Water Delivered.
 - a. Air leaks in suction pipe or stuffing box.
 - b. Speed too low (check with revolution counter).
 - c. Discharge head higher than anticipated.
 - d. Suction lift too high, over 15 feet (check with vacuum gauge).
 - e. Impeller partially plugged.
 - f. Not enough suction head for hot water.
 - g. Mechanical defects.
 1. Impeller worn or damaged.
 2. Casing worn.
 - h. Foot Valve too small.
 - i. Foot Valve not immersed deep enough.
3. Not Enough Pressure.
 - a. Speed too low.
 - b. Air in water.
 - c. Mechanical defects.
 - d. Impeller diameter too small
4. Pump Works for a While and then Quits.
 - a. Leaky suction line.
 - b. Suction plugged.
 - c. Suction lift too high, over 15 feet (check with vacuum gauge).
 - d. Air or gas in liquid.
5. Pump Takes Too Much Power.
 - a. Speed too high.
 - b. Head lower than rating, pumps too much water.
 - c. Liquid either viscous or heavier than water or both.
 - d. Mechanical defects.
 1. Shaft bent.
 2. Impeller binds in casing.
 3. Stuffing box packing too tightly adjusted.

CRANE

VALVES • PUMPS • FITTINGS • WATER TREATMENT • PLUMBING

DEMING PUMPS

CRANE CO. DEMING DIV. •

• SALEM, OHIO 44460

LIMITED WARRANTY
APPLICABLE ONLY TO CONSUMER SALES

Crane Co., Deming Division gives a limited one-year warranty on the machinery of its own manufacture sold herewith. Crane Co., Deming Division warrants to any buyer or consumer that the machinery shall be free of defects in material and workmanship during normal use and service for a period of one year from the date of shipment.

Under this limited warranty, Crane Co., Deming Division shall, within 45 days from the date of notification, (1) repair the product at the factory or the nearest point of repair OR, (2) replace the product or any parts proven defective in material or workmanship OR, (3) refund the purchase price. The choice of such remedies shall be at the sole discretion of Crane Co., Deming Division.

This written warranty is the only warranty made by Crane Co., Deming Division. IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, IF ANY, ARE LIMITED TO THE SAME TERM AS THIS WRITTEN WARRANTY. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

HOWEVER, SOLELY WITH RESPECT TO A BUYER WHO IS NOT A CONSUMER, THE FOREGOING WARRANTY IS IN LIEU OF ANY AND ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, AND NO OTHER WARRANTY IS MADE OR AUTHORIZED TO BE MADE.

The buyer or consumer must promptly and within the applicable limited warranty period notify the installing dealer or contractor in writing of any defect in the machinery and shall permit Crane Co., Deming Division to inspect the product so that it may determine its obligations under the warranty. The buyer or consumer must pay all labor costs, freight charges to the factory or the nearest point of repair, if any, and any charges for the installation of replacement parts, incurred by the Dealer, Contractor or this Company. Upon settlement of its obligations, if any, under this warranty, Crane Co., Deming Division, at its option, shall be entitled to the return of the defective product or part (s) (transportation prepaid).

This limited warranty does not cover unsatisfactory performance or failure due to misuse or abuse of the product, nor will Crane Co., Deming Division be responsible for unsatisfactory performance or failure due to improper installation, adjustment or repair of the product. The specifications for the machinery are descriptive and are not warranties.

This limited warranty does not cover equipment and accessories manufactured by third parties.

CRANE CO., DEMING DIVISION IS NOT RESPONSIBLE FOR CONSEQUENTIAL, SPECIAL, CONTINGENT, INCIDENTAL OR ANY OTHER DAMAGES WHATSOEVER IN CONNECTION WITH REPLACEMENT, REPAIR OR REFUND AS SET FORTH ABOVE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

CRANE CO., DEMING DIVISION
884 South Broadway
Salem, Ohio 44460

WARRANTY

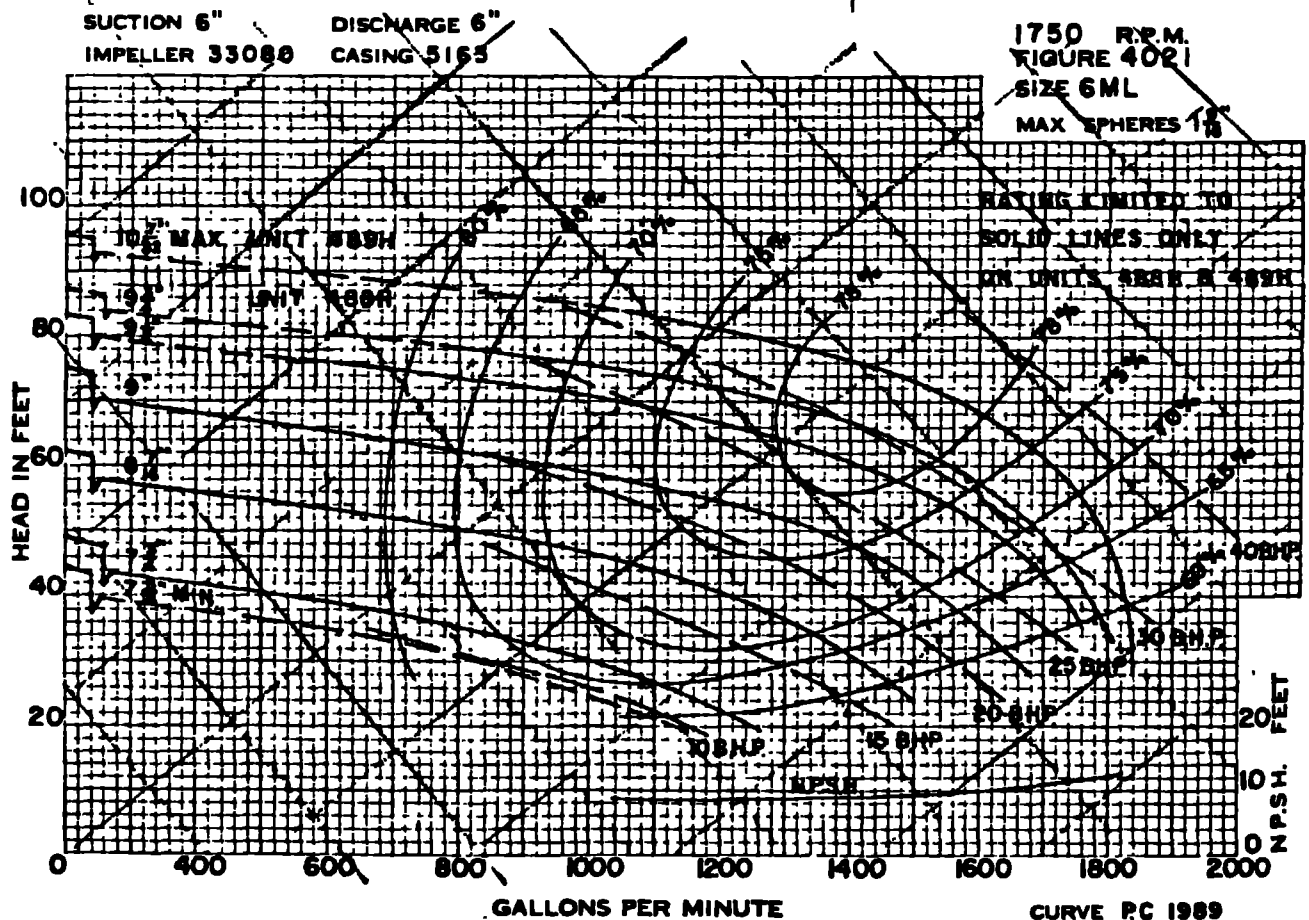
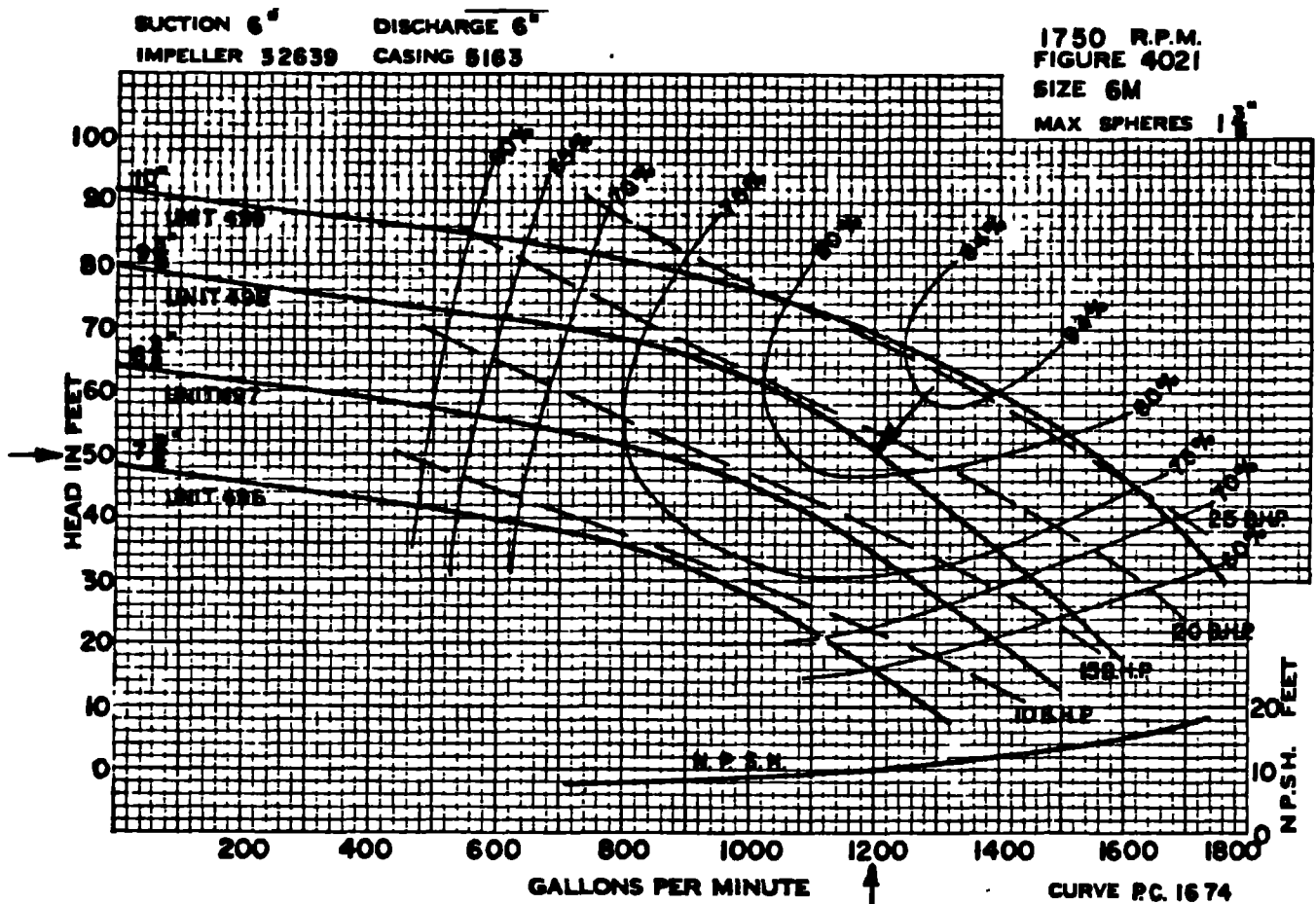
**APPLICABLE WHEN THE MACHINERY IS SOLD AND INSTALLED ON
A COMMERCIAL OR INDUSTRIAL APPLICATION, AND NOT AS A
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**INDUSTRIAL PUMPS
CRANE CO., DEMING DIVISION
SALEM, OHIO, 44460**

The following warranty, which is not a consumer warranty, is made in lieu of any and all implied or express warranties including, without limitation, implied warranties of merchantability and fitness for a particular purpose and no other warranty is made or authorized to be made.

Service under this warranty is the responsibility of the installing dealer or contractor. In the event service is required, the Buyer should request such service directly from the installing dealer or contractor. If for any reason the installing dealer or contractor is unknown or cannot be located, the Buyer should write Crane Co., Deming Division for the name and address of the nearest dealer or contractor.

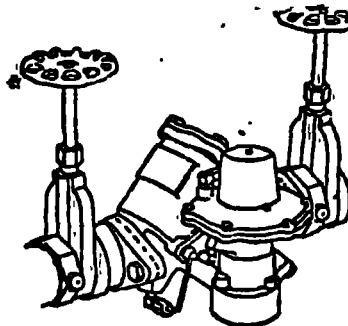
If within one (1) year following date of delivery, any material supplied by Crane Co. hereunder proves defective or fails to meet the agreed specifications, Buyer shall not return it unless requested to do so but shall immediately notify the installing dealer or contractor, stating full particulars in support of his claim and if faulty workmanship or material is involved, or if material fails to meet the agreed specifications, Crane Co. will adjust the matter fairly and promptly. Under no circumstances shall Crane Co. be obligated to allow claims for subsequent or consequential damages or for any labor expense incurred by reason of the use or sale of any material which is defective or fails to meet the agreed specifications. The sole measure of damages shall be the price received therefore by Crane Co.



Customer UTILITY TRANS CO. 3010
Pump Date FIG 4021 3 20 61A

Cust. No. Crane- Deming No.
Rating 1200 GPM 30 Ft. 1750 RPM Date





WILKINS

Model 575

Reduced Pressure Principle Backflow Preventer

Basic Installation Instructions

- 1 Before installing the Model 575 Reduced Pressure Principle Backflow Preventer, flush the water lines thoroughly to remove all debris, chips, and other foreign matter.
- 2 Install the backflow preventer in a horizontal position, with the cast arrow on the side of the device pointing in the direction of water flow.
- 3 Provide adequate space around the backflow preventer so that the test cocks will be accessible for testing, servicing and repair.
- 4 Provide a suitable drain arrangement to drain off spillage from the relief valve. An air gap of at least two times the pipe diameter must be provided between the relief valve and the drain piping (Figure 2).
- 5 Do not pipe the relief valve solidly to a floor drain, sewer, or sump.
- 6 Install the backflow preventer at least 12 inches above the ground or surrounding flood level (Figure 1).
- 7 Always consult local codes for installation methods, approvals, and guidance.

Outdoor Installation

The Model 575 Reduced Pressure Principle Backflow Preventer may be installed outdoors in areas where freezing conditions do not occur. All the basic installation instructions apply. If the device is to be installed in a pit or vault, observe the following additional precautions:

- 1 Make sure that the pit or vault has ample drainage to keep it dry.
- 2 If there is any possibility of freezing, protect the backflow preventer by providing adequate heating or insulation.
- 3 Allow enough space in the pit or vault for testing and repair of the backflow preventer.
- 4 Make sure that the installed backflow preventer will never be submerged in water.

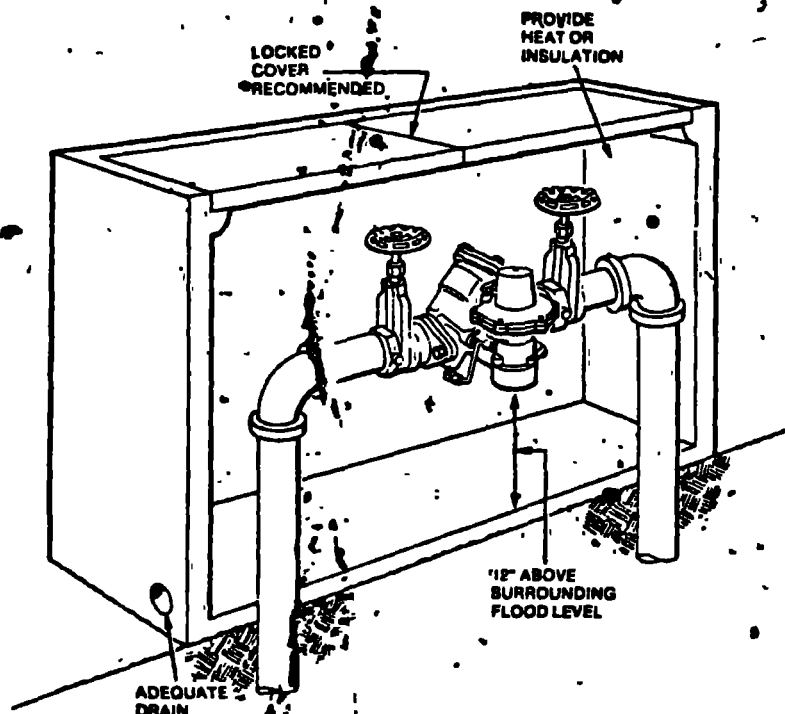


Figure 1. Above Ground Outdoor Installation

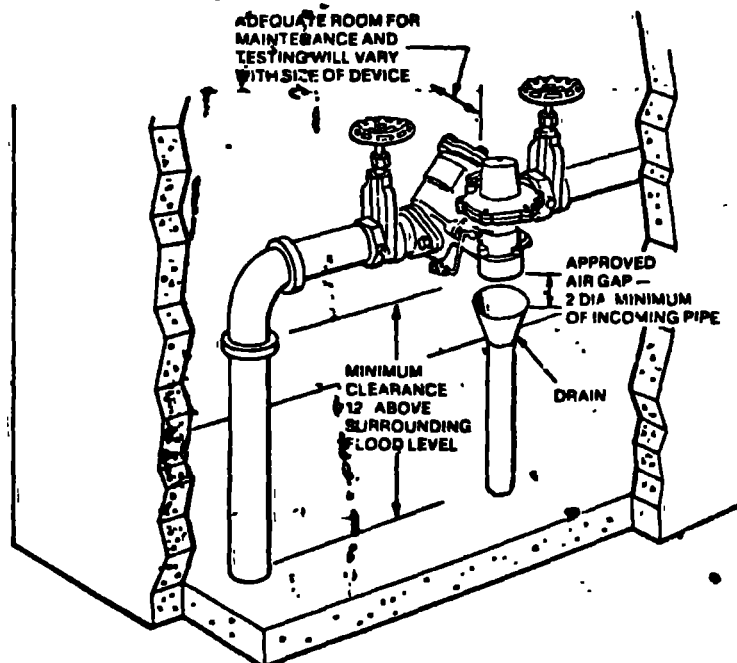


Figure 2. Typical Installation in Building

Indoor Installation

Indoor installation is preferred in areas that are subject to freezing conditions. All the basic installation instructions apply to such installations.

Parallel Installation

Where uninterrupted service from a single meter connection must be maintained, two or more Model 575 Reduced Pressure Principle Backflow Preventers may be connected in parallel (Figure 3). Parallel installation permits testing of backflow preventers individually without interrupting service. When two backflow preventers are used in parallel, the total capacity of the devices must equal or exceed the capacity of the main line. All the basic installation instructions apply to a parallel installation. In addition, make sure that adequate space is provided between the parallel devices for testing and repair. For parallel installation of 3" or larger Model 575 Reduced Pressure Principle Backflow Preventers refer to Model 575 M-6, M-8, or M-10 manifold brochures.

Install the Model 575 Reduced Pressure Principle Backflow Preventer where spillage from the relief valve will not cause damage, problems, or be a nuisance. Always install a funnel arrangement with piping to drain off any spillage. Do not connect any piping directly to the relief valve.

Placing the Device in Service

After installation has been completed, place the Model 575 Reduced Pressure Principle Backflow Preventer in service as follows:

1. Start with both gate valves closed. Slowly open the inlet gate valve until the backflow preventer is completely pressurized.
2. A continual discharge from the relief valve may occur until all valve surfaces have properly seated. If a continual discharge from the relief valve is noted, close the inlet gate valve and let the backflow preventer stand until the discharge stops. Then, pressurize the device as instructed in Step 1.
3. If the discharge from the relief valve

does not stop in Step 2, remove the inlet check valve and check for debris. Flush the backflow preventer thoroughly. Install the inlet check valve and pressurize the backflow preventer as instructed in Step 1.

4. After the backflow preventer has been pressurized, vent all trapped air from both check valves and the relief valve by opening the four vent screws (Figure 4). When liquid appears at all of the vents, close the four vent screws. Do not remove the vent screws to bleed air.
5. Slowly open the discharge gate valve. The Model 575 Reduced Pressure Principle Backflow Preventer is now in service.
6. If "spriting" from the relief valve is noted check the system for pressure fluctuations and water hammer conditions. Install suitable water pressure reducing valves or water hammer shock arrestors as needed.
7. After the backflow preventer has been properly installed, test the device (see instructions for detailed test procedure). If the device fails the test, remove it from service and flush the device and thoroughly flush the device. If the relief valve fails to operate properly install the sensing line for clogging (see manual for instructions). Clean the rubber seal of all debris and place the unit back in service.



Figure 3. Typical Parallel Installation

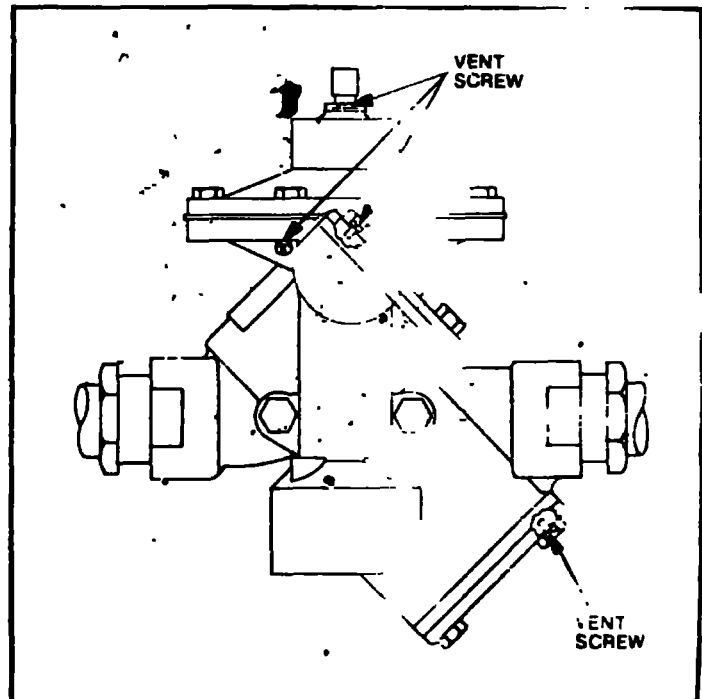


Figure 4. Venting Check and Relief Valves

SINCE 1904

WILKINS REGULATOR CO.

A Division of Zurn Industries, Inc.

1747 Commerce Way
Paso Robles, CA 93446
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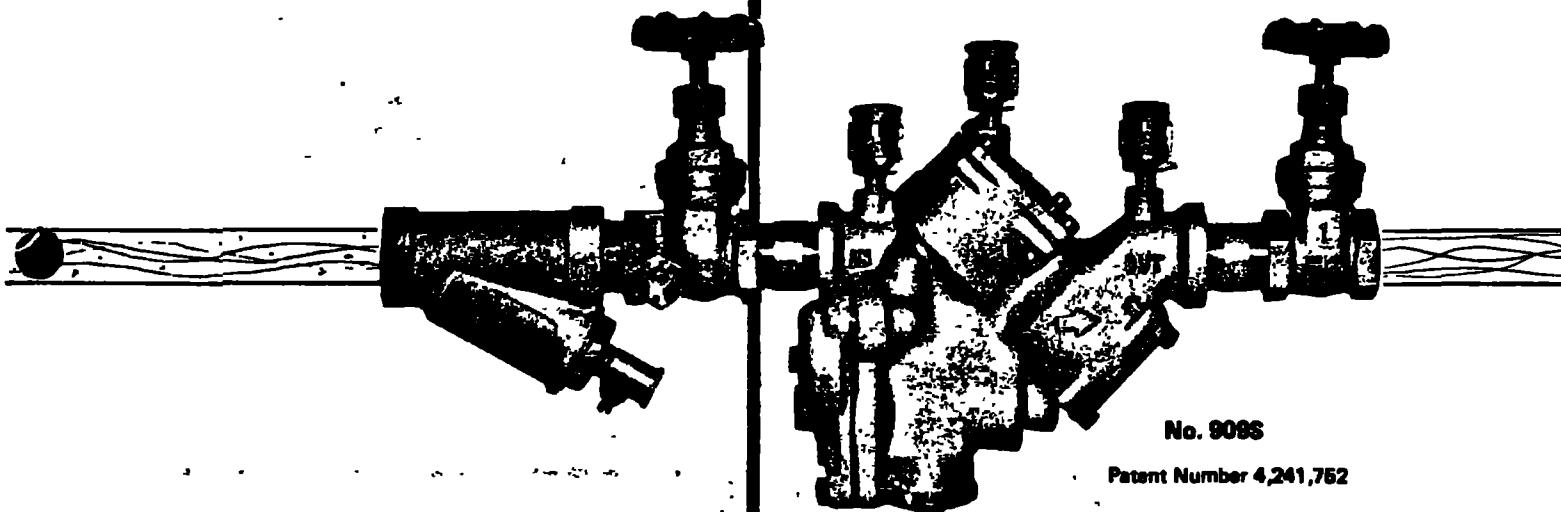
WATTS REGULATOR

THE
NAME
THAT
PROTECTS
YOUR
NAME

Series 909

SIZES $\frac{3}{4}$ " to 10"

REDUCED PRESSURE
PRINCIPLE
BACKFLOW PREVENTERS



No. 909S

Patent Number 4,241,752

POSITIVE CROSS CONNECTION CONTROL

- **INSTALLATION**
- **SERVICE**
- **REPLACEMENT PARTS**
- **and MAINTENANCE**

For Field Testing Procedure request Bulletin S-FT-TK-9A.

WATTS REGULATOR COMPANY

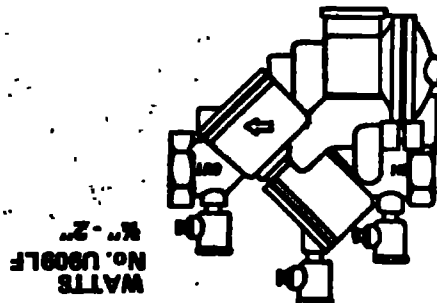
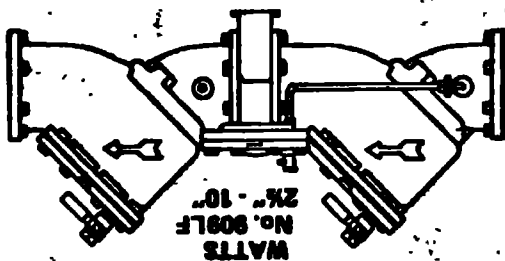
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SOESTDUINEN, THE NETHERLANDS

Manufacturers of the largest and most complete line of plumbing and heating safety valves and controls.

Basic Installation Instructions



a backflow preventer cannot function according to its designed purpose and tested performance without causing discharge from the relief vent when the water supply pressure fluctuates during static no flow conditions.

Therefore, to avoid discharge where objectionable, use a check valve ahead of the installation to "lock-in" the downstream pressure so as not to effect the operation pressure differential between the supply and downstream of the first check in the backflow preventer.

6. Backflow preventers should never be placed in pits unless absolutely necessary and then only when and as approved by local codes. In such cases, provision should be made to always vent above flood level or for a pit drain to insure an adequate air gap below the relief port. Consult your local or state plumbing or health inspector.

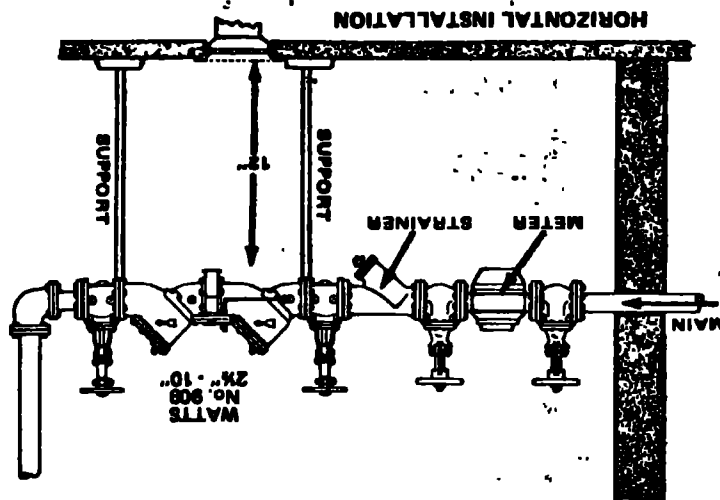
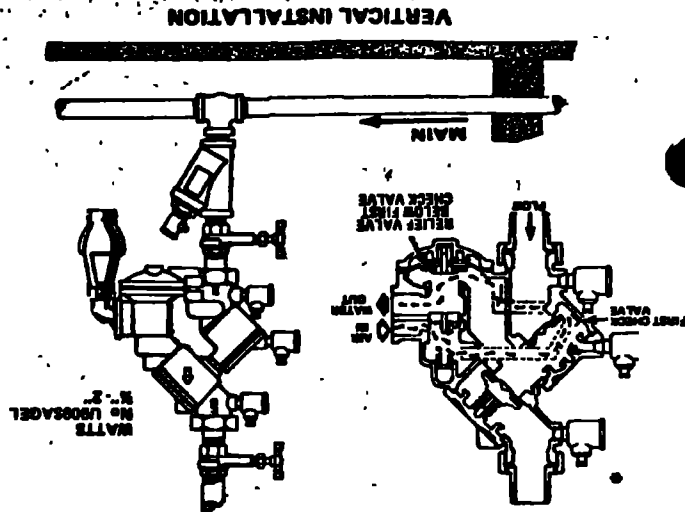
H. It is important that Series 908 Backflow Preventers be inspected periodically for any discharge from the relief valve which will provide a visual indication of need for cleaning or repair or check valves. Also, testing for proper operation of the device should be made periodically in compliance with local codes, but at least once a year or more often, depending upon system conditions. See Watts instruction manual for test procedures.

I. Relief vent will discharge water, when during no-flow periods (1) the first check valve is fouled, or (2) the inlet supply pressure to the device drops sufficiently due to upstream pressure fluctuations to effect the required operating differential between the inlet pressure and the reduced pressure zone. Otherwise such relief ("spitting") can occur when the second check is fouled during emergency backflow or resulting from a water hammer condition. (See tag on valve for preventive and corrective means.)

Installation - Indoors, Figure 1

For indoor installations, it is important that the device be easily accessible to facilitate testing and servicing. Series 908 may be installed either vertically or horizontally. If installed vertically, flow must be (up) 1/2" - 2" and (down) 2 1/2" - 10". If it is located in a line close to a wall, be sure the test cocks are easily accessible. A drain line should be piped from the relief valve as shown, where evidence of discharge will be clearly visible and so that water damage will not occur. Therefore, never install in concealed locations. In sizes 2 1/2" - 10", the complete relief valve unit can be removed and mounted on the opposite side of the device, in order to provide better accessibility for servicing.

- WATTS Series 908 Backflow Preventers may be installed in either a vertical or horizontal position. When installed vertically the direction of flow must be (up) for 1/2" - 2" and (down) for 2 1/2" - 10". This positions the relief valve below the first check valve enabling the zone to drain through the relief valve outlet. (See illustration below.) They should always be installed in an accessible location to facilitate testing and servicing. Check the local codes to insure that the unit is installed the proper height above the ground.
- Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. A strainer should be installed as shown, ahead of No. 908 Series devices to protect the discs from unnecessary fouling.
- CAUTION:** Do not install with strainer when backflow preventer is used on seldom-used water lines which are called upon only during emergencies, such as fire sprinkler lines, etc.
- Water discharge from the relief valve should be vented in accordance with code requirements. The relief valve should never be solidly piped into a drainage ditch, sewer, or sump. The discharge pipe should be terminated approximately 12" above the ground or through an air gap piped to a floor drain.
- After initial installation, a discharge from the relief valve opening may occur until all seating surfaces have become seated or due to inadequate initial flushing of pipe lines to eliminate dirt and pipe compounds. If flushing will not clear, remove the first check valve and clean thoroughly. See page 4 or 5.
- When a reduced pressure principle backflow preventer is installed for dead-end service applications, such as for boiler feed lines, cooling tower make-up and other periodic flow requirements, such



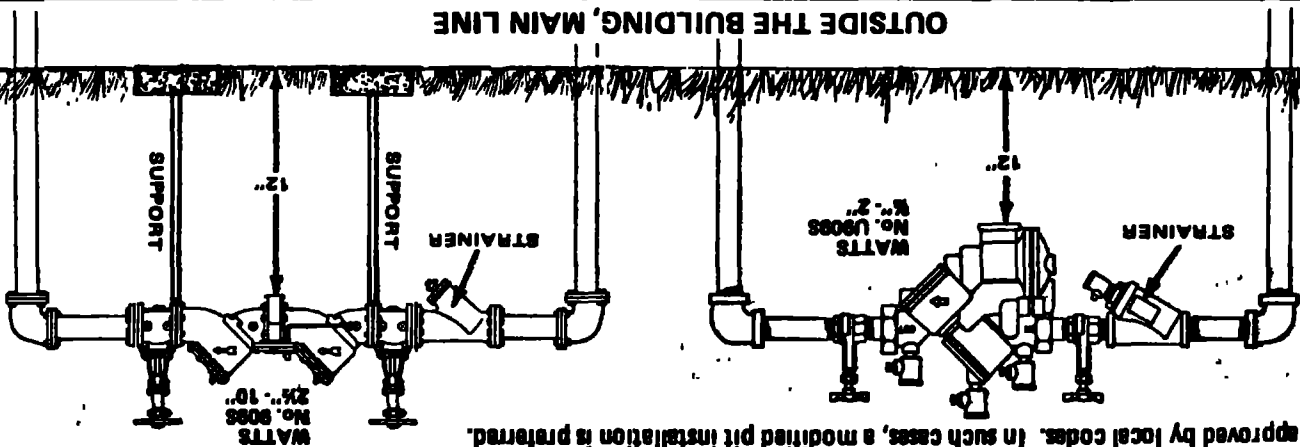
Installation - Outside Building Above Ground, Figure 2

In an area where freezing conditions do not occur, Series 909 can be installed outside of a building. The most satisfactory installation is above ground and should be installed in this manner whenever possible.

In an area where freezing conditions can occur, Series 909 should be installed in a properly insulated utility building or shelter.

Series 909 may be installed in a vertical or horizontal line and in an accessible location to facilitate testing and servicing. A discharge line should be piped from the relief valve connection making sure that there is adequate drainage. Never pipe the discharge line directly into a drainage ditch, sewer, or sump. Series 909 should never be installed where any part of the unit could become submerged in standing water. Consideration should be given to the installation of external support structure as applicable on larger sizes.

It is generally recommended that backflow preventers never be placed in pits unless absolutely necessary and then only when approved by local codes. In such cases, a modified pit installation is preferred.



OUTSIDE THE BUILDING, MAIN LINE

Installation - Parallel Devices Figure 3

CONSULT LOCAL CODES FOR APPROVAL

An optional installation of Series 909 Backflow Preventers is the use of two or more smaller size devices piped in parallel (where approved) to serve a larger supply pipe main. This type of installation is employed whenever it is vital to maintain a continuous supply of water and where interruptions for testing and servicing would be unacceptable. It also has the advantage of providing increased capacity where needed beyond that provided by a single valve and permits testing or servicing of an individual valve without shutting down the complete line.

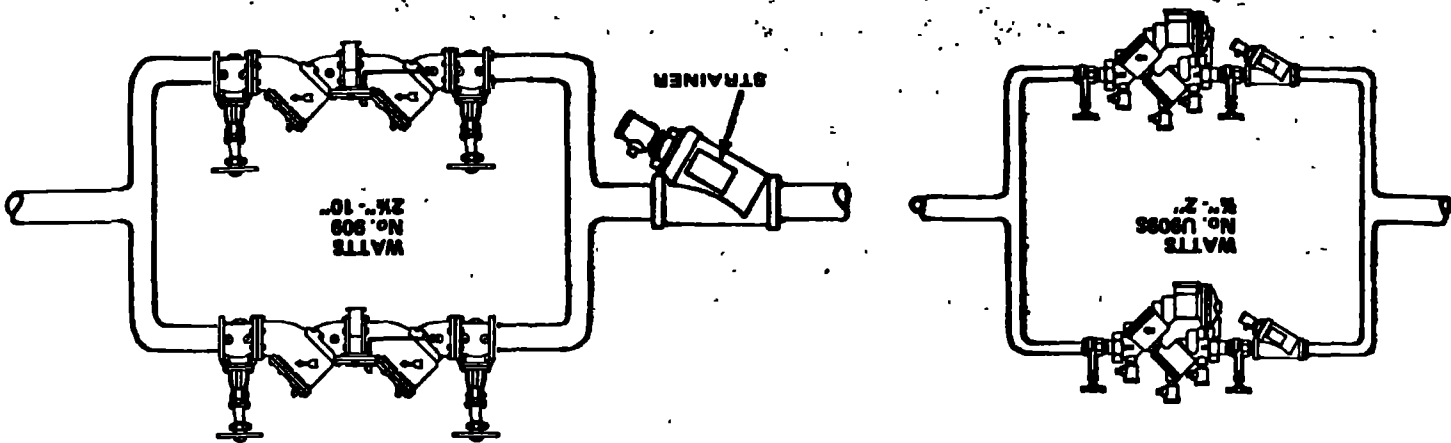
For a two-valve installation as shown, the total capacity of the devices should equal or exceed that required by the system. Table One listing the size No. 909 devices required to meet a certain capacity.

The number of devices used in parallel should be determined by the engineer's judgement based on the operating conditions of a specific installation.

TABLE ONE - CAPACITY REQUIRED FOR SYSTEM

50 GPM	100 GPM	150 GPM	200 GPM	250 GPM	350 GPM	450 GPM	640 GPM	1000 GPM	2000 GPM	3000 GPM	5000 GPM
Two 1/2" Devices	Two 1" Devices	Two 1 1/2" Devices	Two 1 1/2" Devices	Two 1 1/2" Devices	Two 2" Devices	Two 2 1/2" Devices	Two 3" Devices	Two 4" Devices	Two 6" Devices	Two 8" Devices	Two 10" Devices

Table shows total capacity provided with dual valve installations of various sizes.



Servicing First and Second Check Valves

Sizes: 3/4" to 2"

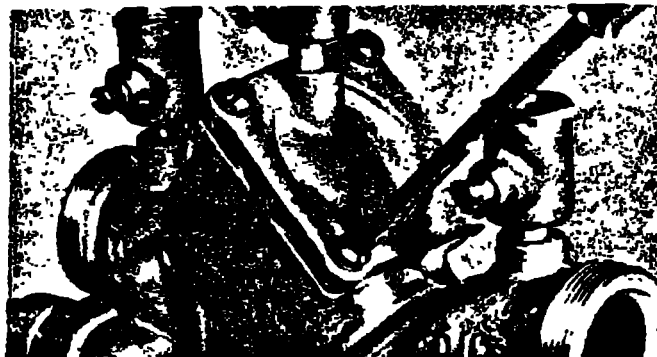
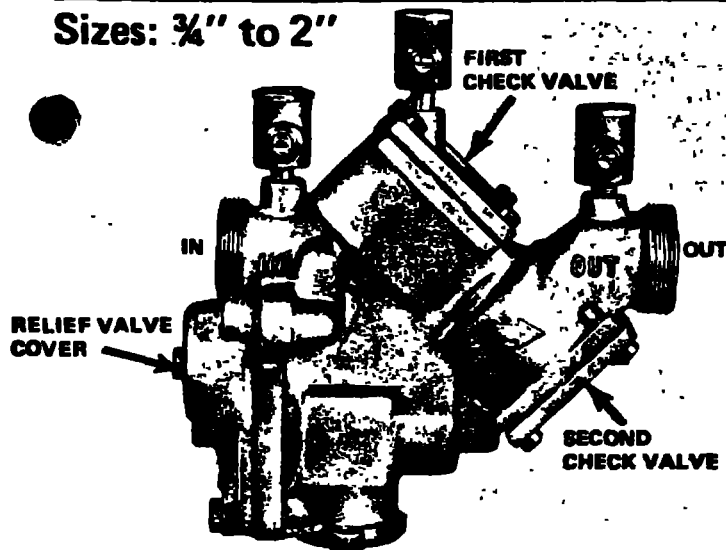


Figure 2

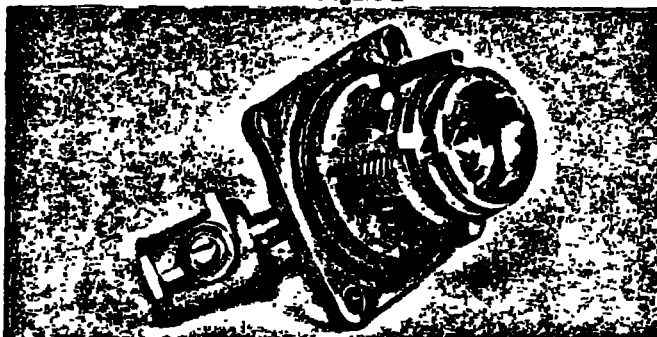


Figure 3

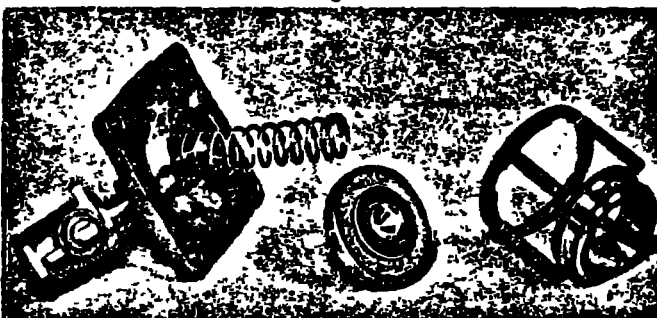


Figure 4

1. Remove the four screws holding the first check valve cover. Figure 2.

2. Lift off the first check valve cover. The check valve inside will come out with the cover and is attached with a bayonet type locking arrangement. Figure 3.

3. Holding the check valve module in both hands, rotate the assembly 1/4 turn. This will disengage the disc assembly, spring and seat cover into individual components. Figure 4.

4. The disc assembly may be cleaned and reassembled, or depending upon its condition, it may be discarded and replaced with a new assembly from the service kit. "O" rings should be cleaned or replaced as necessary and lightly greased with the FDA approved silicon grease which is also furnished with the service kit.

5. Reassemble the check valve module in the reverse order. Service is identical for both the first and second check valves.

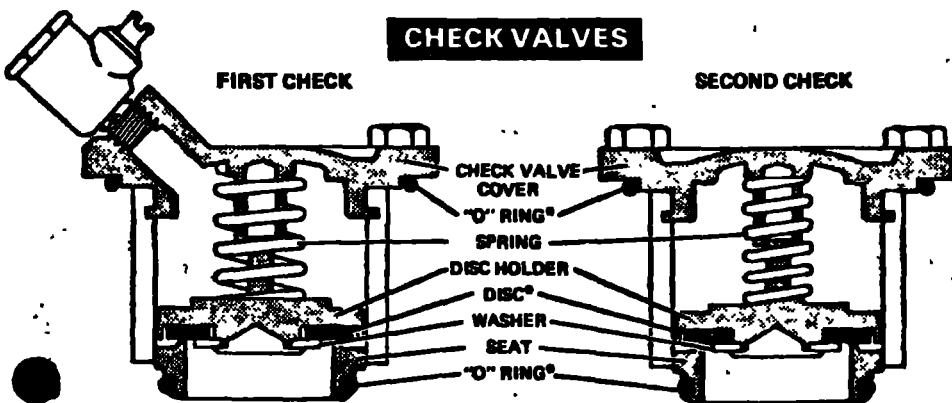
Note: The springs and covers of the first and second check valves are not interchangeable.

3/4" - 2" Replacement Parts

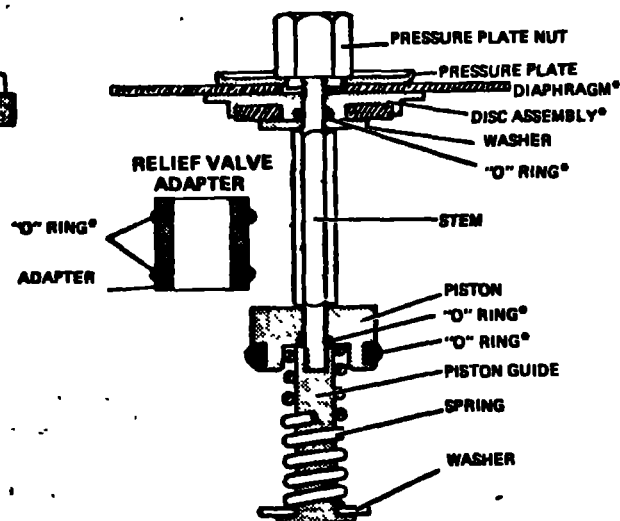
CHECK VALVES

FIRST CHECK

SECOND CHECK



RELIEF VALVE ASSEMBLY



SIZE	VALVE NO.	REPAIR KIT NO.
3/4" - 1"	909	909-C-RK
1 1/4" - 2"	909	909-F-RK

Standard Repair Kit includes all items marked.*

Servicing the Relief Valve

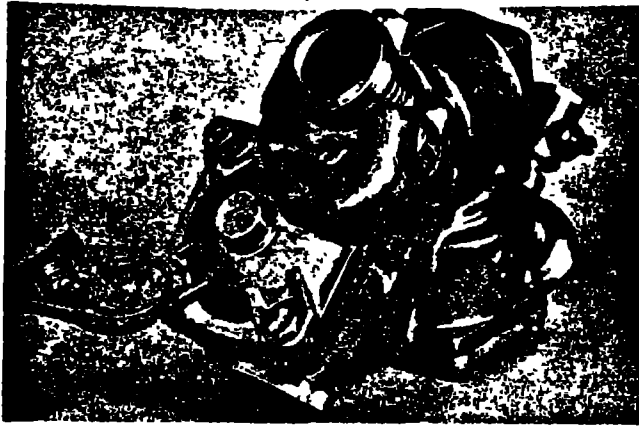


Figure 5

1. Remove the four bolts that hold the relief valve cover in place. Figure 5.
 2. Remove the cover. The stainless steel adapter, with "O" rings attached, will be free to be removed simultaneous with the removal of the cover. Figure 6. Pull out the relief valve assembly. Figure 6. Note: the spring tension in the relief valve assembly is contained in the design of the relief valve; therefore, the relief valve can be removed in a one-piece spool-type assembly. Figure 7.
 3. The relief valve seat and disc may be cleaned without disassembly of the relief valve assembly. If it is determined that the relief valve diaphragm and or disc should be replaced, the relief valve module can be readily disassembled without the use of special tools.
 4. To disassemble the relief valve module, (Figure 7) hold the center hexagonal stem with an open end or an adjustable wrench (Figure 8). While simultaneously turning the hex head on the end of the relief valve assembly. The relief valve spring will unload during disassembly. Repeat procedure turning hex nut on the diaphragm end. Figure 9 shows complete disassembly of module.
 5. The relief valve diaphragm and or relief valve disc may be replaced with new parts from the service kit. Reassembly of the relief valve may be accomplished in the reverse order. "O" rings should be replaced as necessary and lightly greased with FDA approved silicon grease which is furnished with the service kit.
- CAUTION:** When reassembling the relief valve, care should be taken to insure that, when bolting the relief valve into place, the relief valve module and stainless steel adapter are in position. Manually close cover to body. Slight spring tension resistance will be encountered. Cover should be pressed against body to make sure the shaft is inserted straight. If cover will not press against body, assembly is crooked and tightening bolts will bend shaft. Do not force the cover into place as damage may result from misalignment.

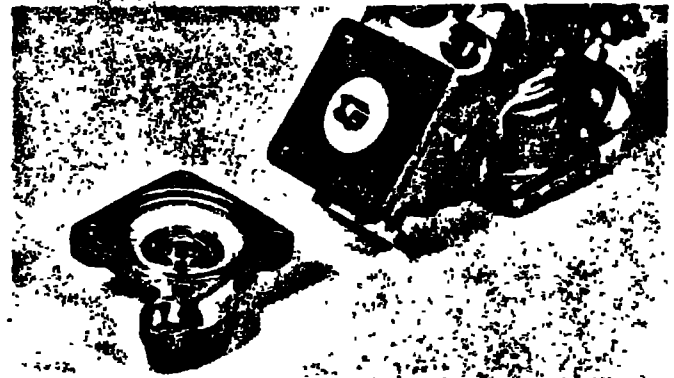


Figure 6

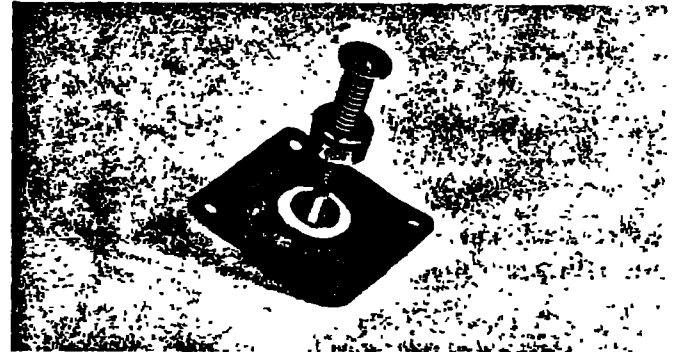


Figure 7

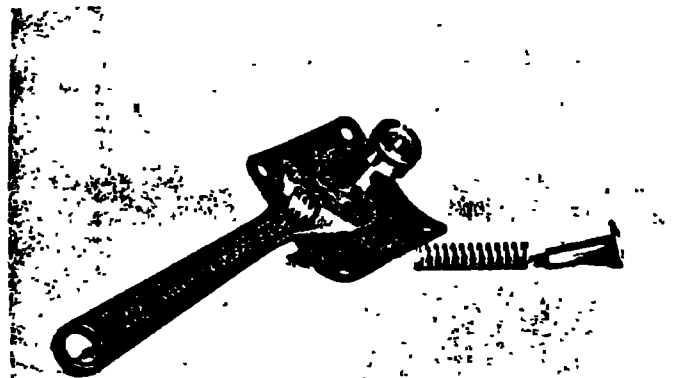


Figure 8

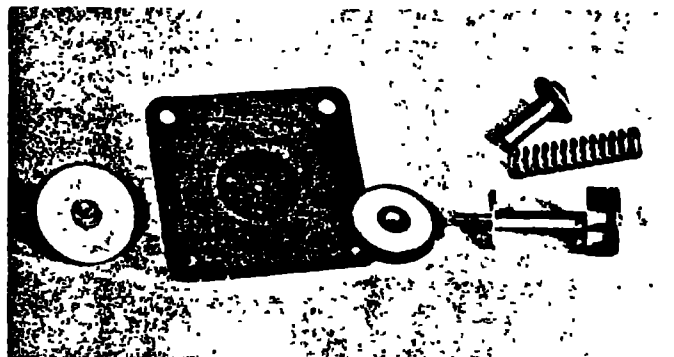
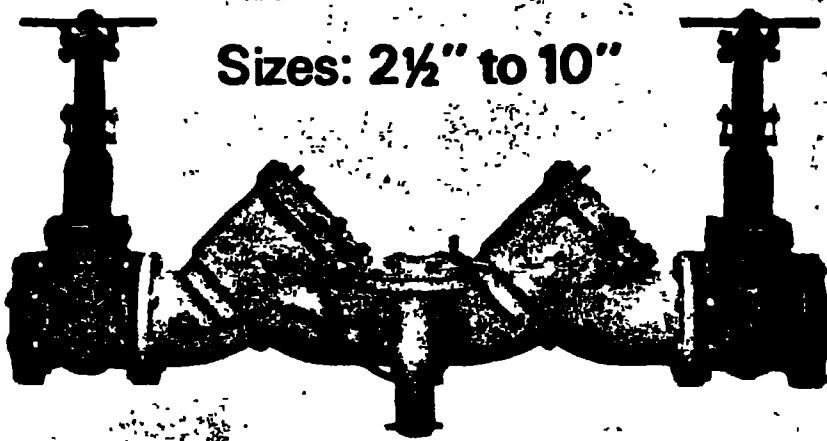


Figure 9

Servicing First and Second Checks

Sizes: 2½" to 10"



First and Second Checks are not interchangeable.

1. Remove hatch cover bolts. NOTE: The 909 is designed so that when the bolts are backed off ½", all the spring load is released from the cover and retained by the check module. CAUTION: Be sure to verify this before removing all the bolts.

2. Lift check valve module straight out taking care not to hit and damage seat ring.

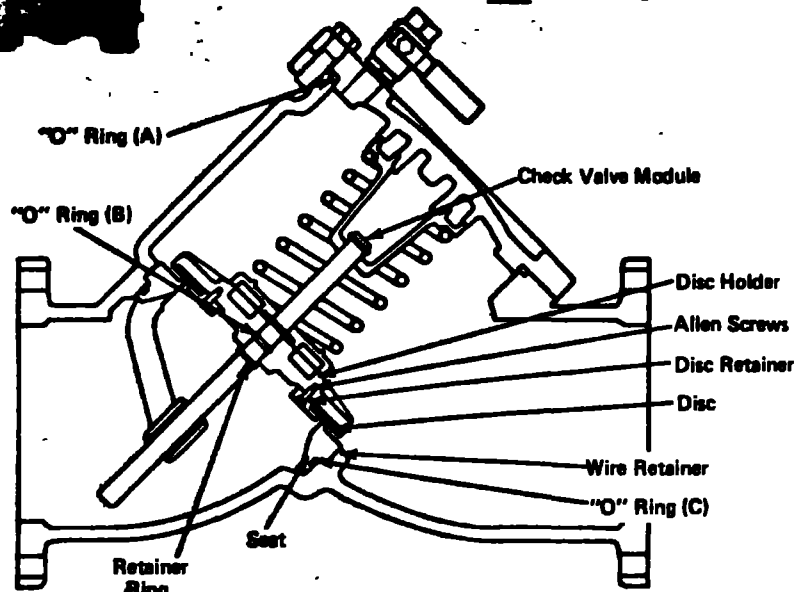
3. The seat ring may be removed and replaced by pulling out the two wire retainers. The wire retainers are 10" long. One is drawn out clockwise and the other is drawn out counter clockwise.

4. With the retainer wires removed, the seat ring can be lifted straight up and removed.

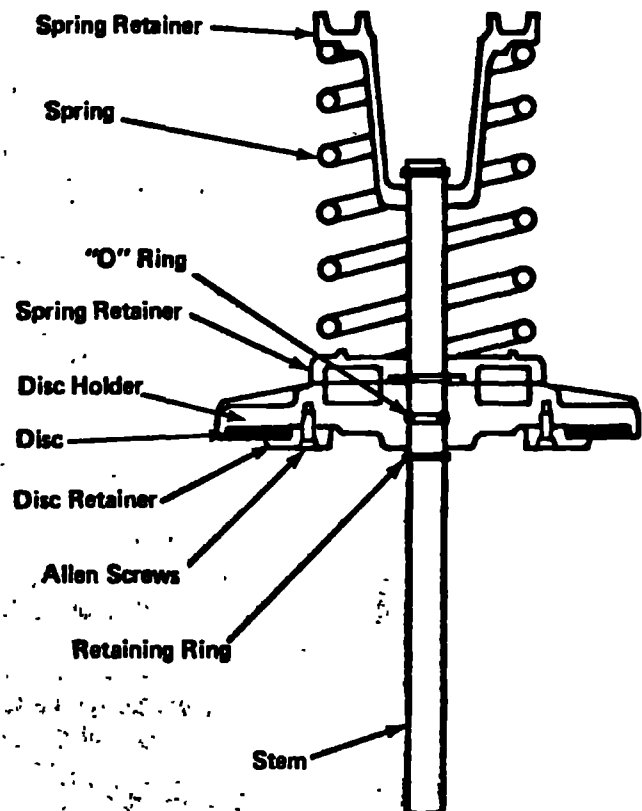
5. CAUTION: The check valve spring is in compression. The spring load is captured by the two spring retainers and the stem. The spring retainers are not to be removed for servicing. If there is a need to replace the spring, spring retainer or stem, an assembled module must be obtained from the factory.

6. To replace the disc, simply remove the Allen head socket screws. Lift off the disc retaining plate and the disc. Reverse this procedure to install the new disc.

7. If the disc holder has been damaged by freezing or severe water hammer, it can be replaced in the field. Remove the retaining ring and slide the disc holder off the stem. Remove the "O" ring from the stem and replace with a new one. Apply grease to the "O" ring and slide the new disc holder into place. Re-install the retaining ring. NOTE: the disc holder should not be removed when servicing only the disc.



CHECK MODULE ASSEMBLY



Servicing the Relief Valve

1. Remove the relief valve cover bolts. Note the 909 is designed so that when the bolts are backed off $\frac{1}{2}$ " all the relief valve spring load is retained by the bottom plug spring module. Caution: Be sure to verify this before removing all the bolts.

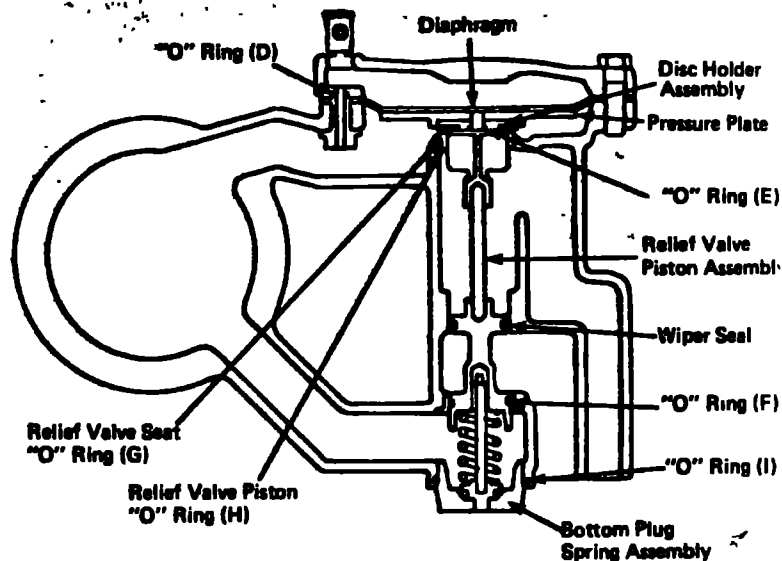
2. Remove the cover and diaphragm. The relief valve piston assembly can be lifted straight up and out.

3. Replace the wiper seal and piston "O" ring and apply grease to the "O" ring.

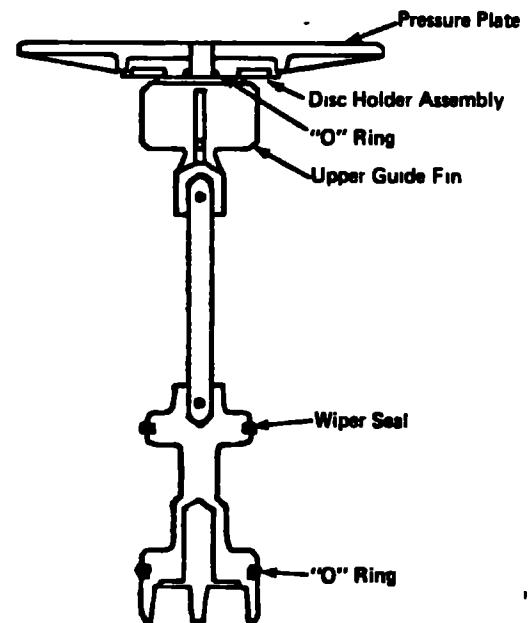
4. To replace the relief valve disc, hold the upper guide fin and unscrew the diaphragm pressure plate. It may be necessary to lightly tap the cast webs and the pressure plate to loosen. Replace with a new disc holder assembly and "O" ring. Note: the disc rubber is molded into the disc holder and is supplied as a disc holder assembly.

5. Removal of the bottom spring assembly. During normal field service there is no need to remove the bottom plug spring assembly other than inspection. It can be removed by simply unscrewing with a large pipe wrench.

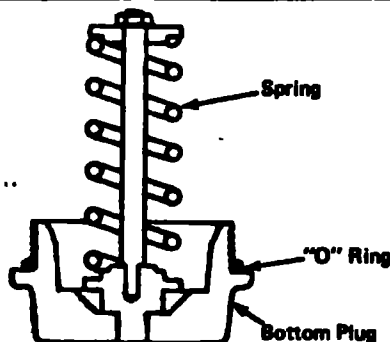
Caution: The spring as retained on the bottom plug is highly loaded. NO attempt should be made in the field to remove the spring. For replacement, a complete bottom plug assembly must be obtained from the factory.



RELIEF VALVE PISTON ASSEMBLY



BOTTOM PLUG SPRING ASSEMBLY



2½"-10" Replacement Parts

SERVICE PARTS KIT NUMBERS

Valve Size	Check Modules	Relief Valve
2½", 3"	909-G-RK	909-H-RK
4"	909-J-RK	909-JK-RK
6"	909-K-RK	909-JK-RK
8"	909-L-RK	909-M-RK
10"	909-N-RK	909-M-RK

CHECK MODULE KIT CONTAINS

(2) "O" Rings (A)
(2) Disc

RELIEF VALVE KIT CONTAINS

Set of "O" Rings (D), (E), (F)
Diaphragm
Disc Holder Assembly
Wiper Seal

Series 909 Trouble Shooting Guide

PROBLEM	CAUSE	SOLUTION
VALVE SPITS PERIODICALLY FROM THE VENT.	Fluctuating supply pressure.	Place a soft seated check valve immediately upstream of the device.
VALVE DRIPS CONTINUALLY FROM THE VENT.	Fouled first check.	Flush valve. If flushing does not resolve problem, disassemble valve and clean or replace the first check.
	Damaged or fouled relief valve seat.	Clean or replace the relief valve seat.
	Relief valve piston "O" ring not free to move due to pipe scale, dirt or build up of mineral deposits.	Clean, grease or replace the piston "O" ring.
	Excessive backpressure, freezing, or water hammer has distorted the second check.	Eliminate source of excessive backpressure or water hammer in the system downstream of the device. Replace defective second check assembly. In case of freezing; thaw, disassemble, and inspect internal components. Replace as necessary.
	Electrolysis	Electrically ground the piping system and/or electrically isolate the device with plastic pipe immediately upstream and downstream of the device.
VALVE EXHIBITS HIGH PRESSURE DROP.	Fouled strainer (if present)	Clean strainer element or replace.
	Valve too small for flows encountered.	Install proper size device based upon flow requirements.
NO WATER FLOWS DOWNSTREAM OF VALVE.	Valve installed backwards.	Install valve in accordance with flow direction arrow.
VALVE QUICKLY AND REPEATEDLY FOULS FOLLOWING SERVICING.	Debris in pipe line.	Install a strainer. If already equipped with a strainer, install finer mesh strainer element in the strainer.

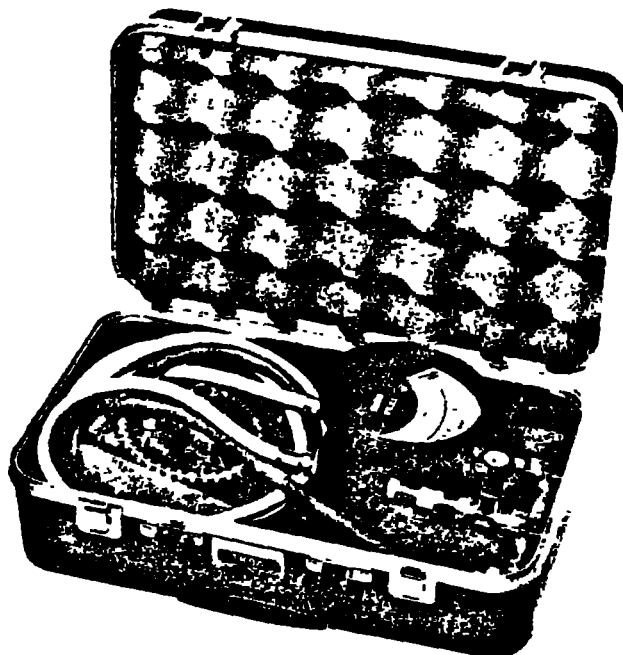
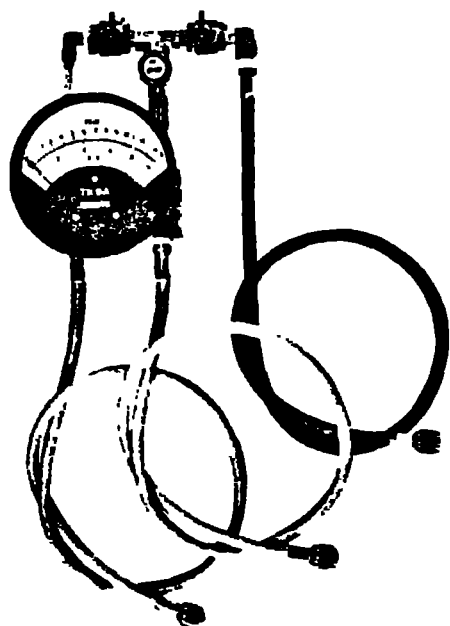


THE NAME THAT PROTECTS YOUR NAME
Box 628, Lawrence, MA 01842 (617) 688-1811
Toronto, Canada Soestduinen, The Netherlands

LIMITED WARRANTY: Watts Regulator Company warrants each product against defects in material and workmanship for a period of one year from the date of original shipment. In the event of such defects within the warranty period, the Company will, at its option, replace or recondition the product without charge. This shall constitute the exclusive remedy for breach of warranty, and the Company shall not be responsible for any incidental or consequential damages, including, without limitation, damages or other costs resulting from labor charges, delays, vandalism, negligence, fouling caused by foreign material, damage from adverse water conditions, chemicals, or any other circumstances over which the Company has no control. This warranty shall be invalidated by any abuse, misuse, misapplication or improper installation of the product. THE COMPANY MAKES NO OTHER WARRANTIES EXPRESS OR IMPLIED EXCEPT AS PROVIDED IN THIS LIMITED WARRANTY.

WATTS REGULATOR

THE
NAME
THAT
PROTECTS
YOUR
NAME



The Watts No. TK-9 Mod. "A" Backflow Preventer Test Kit is a compact portable testing device especially made for testing all Reduced Pressure Principle Backflow Prevention Devices. The TK-9 Mod. "A" is easily connected to any RPZ device enabling accurate testing of "zone" differential pressure, relief valve opening differential, fouled check valves or similar problems that visual inspections cannot locate. The unit is encased in a rugged carrying case for easy handling and accessibility.

SPECIFICATIONS

- Maximum working pressure – 175 psi.
- Maximum working temperature – 210°F.
- Gauge – 4½" diameter face dual scale
0-15 psid and 0-1 kg/cm², ±2% accuracy full scale.
- Test Valves – (2) ball valves and (1) needle valve.
- Hoses – (3) 3' with female threaded swivel couplings.
- Adapters – (3) ¼" threaded coupling adapters
(3) ½" x ¼" bushings
(3) ¾" x ¼" bushings
- 1 – 16" securing strap.
- 1 – Moisture resistant instruction guide.
- Case – light weight, shock resistant molded plastic with foam inserts.

GENERAL COMMENTS

Reduced pressure principle backflow preventers must be inspected and tested periodically, in accordance with local codes, to ensure proper operation of check valves within the unit.

A differential pressure gauge is recommended for Test No. 1 rather than a manometer for the following reasons: It utilizes minimum time to perform the test. It eliminates the necessity of closing the inlet gate valve which could release pipe scale and foreign matter into the backflow preventer. Only a slight amount of water is "spilled" in test. A mercury manometer could cause a pollution hazard.

TEST SET UP

Reduced Pressure Principle Device

Close Valves (A), (B) and (C) on Test Kit.

Connect the No. 2 Test Cock of the device to the "HIGH" Hose.

Connect the No. 3 Test Cock of the device to the "LOW" Hose.

Close No. 2 gate valve of the device.

Open Test Cocks No. 2 and No. 3.

Open "Vent" (C) valve.

Open "High" (A) valve and bleed to atmosphere until all the air is expelled.

Close the "High" (A) valve. Open the "Low" (B) valve and bleed to atmosphere until all air is expelled. Close "Low" (B) valve. Close "Vent" (C) valve.

Connect the No. 4 Test Cock of the device to the "VENT" Hose.

TEST PROCEDURE

Reduced Pressure Principle Device

FIELD TEST EQUIPMENT REQUIRED

REDUCED PRESSURE PRINCIPLE
BACKFLOW PREVENTER TEST KIT

TEST No. 1

PURPOSE:

To test Check Valve No. 2 for tightness against reverse flow.

REQUIREMENTS:

Valve must be tight against reverse flow under all pressure differentials. Slowly open the "High" (A) and "Vent" (C) valves and keep the "Low" (B) valve closed. Open the No. 4 test cock. Indicated pressure differential will decrease slightly. If pressure differential continues to decrease (until the vent opens) the No. 2 Check Valve is reported as "leaking".

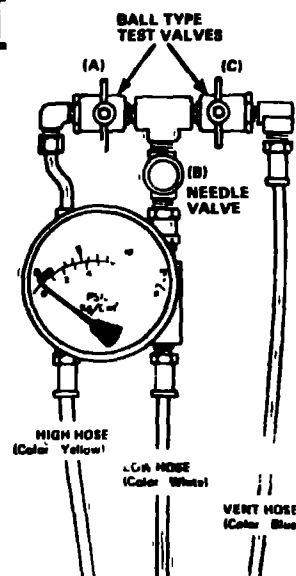
TEST No. 2

PURPOSE:

To test Gate Valve No. 2 for tightness.

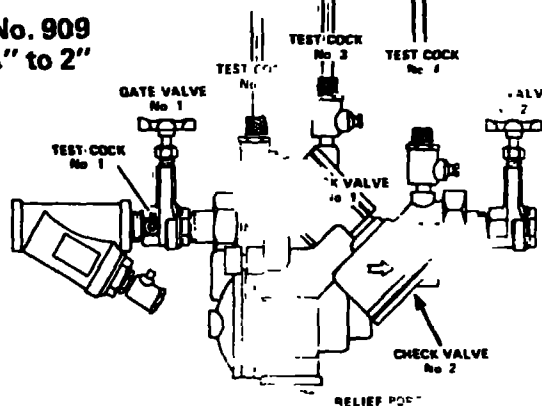
REQUIREMENTS: After passing test No. 1 continue to test No. 2 by closing Test Cock No. 2. The indicated pressure differential will decrease slightly. If pressure differential continues to decrease (approaching "zero") the No. 2 Gate Valve is reported to be "leaking".

CAUTION: To prevent freezing, hold Test Kit vertically to drain differential gauge and hoses prior to placing in case.



Schematic Diagram

Watts No. 909
Sizes $\frac{3}{4}$ " to 2"



TEST No. 1

PURPOSE:

To test Check Valve No. 1 for tightness.

REQUIREMENTS:

Valve must be tight against reverse flow under all pressure differentials. Close "High" (A) valve and open Test Cock No. 2. Close Test Cock No. 4. Disconnect "Vent" Hose at Test Cock No. 4. Open valves (B) and (C) bleeding to atmosphere, then closing valve (B) return the system to a normal static condition. Observe pressure differential gauge. If there is a decrease in the indicated value, the No. 1 Check Valve is reported as "leaking".

TEST No. 2

PURPOSE:

To test operation of pressure differential relief valve.

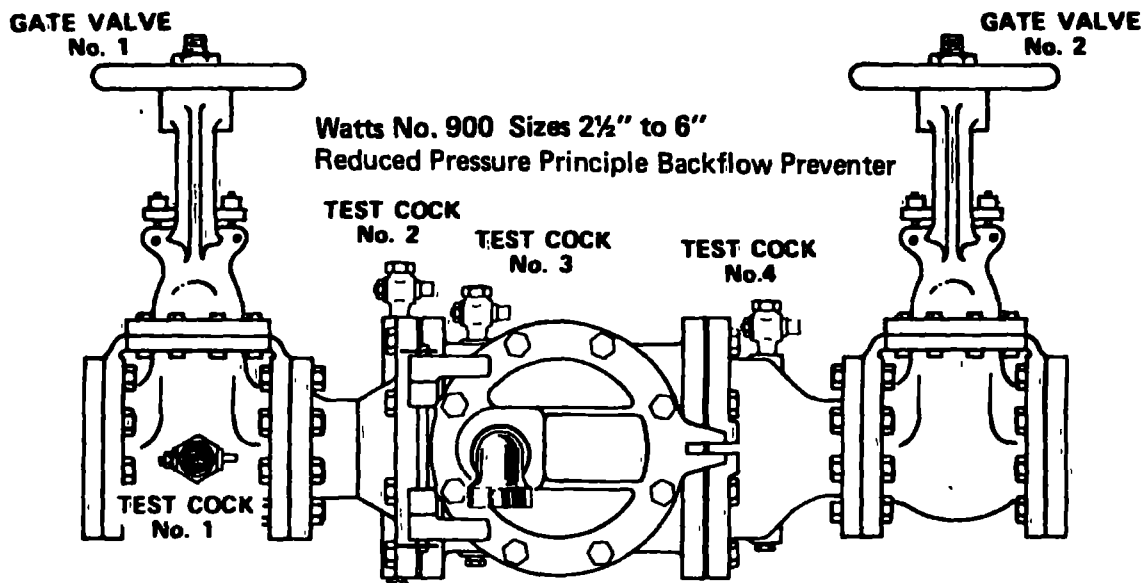
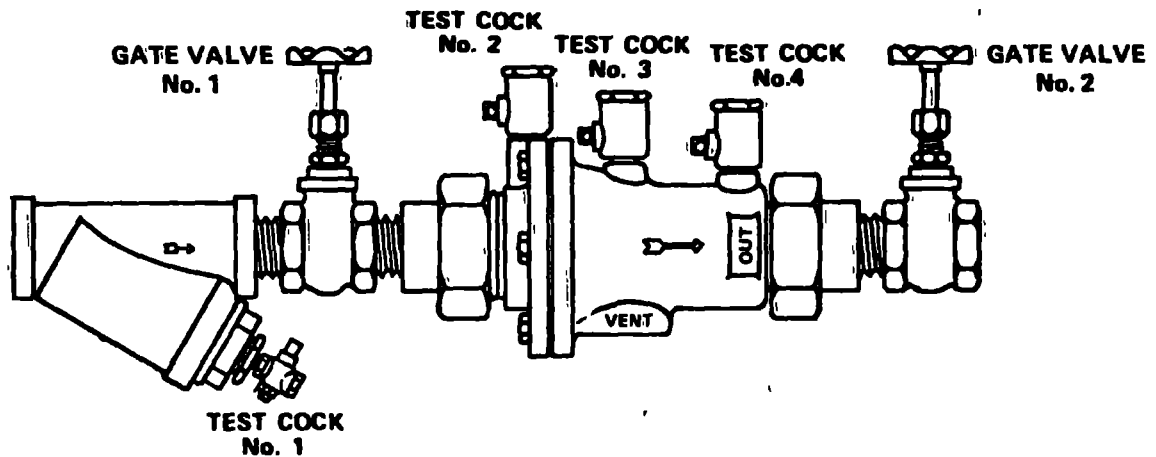
REQUIREMENTS:

The pressure differential relief valve must operate to the "zone" between the two check valves at least 2 psi less than the supply pressure. Close "Vent" (C) valve. Open the "High" (A) valve. Open the "Low" (B) valve very slowly until the differential gauge needle starts to drop. Hold the valve at this position and observe the gauge reading at the moment the first discharge is noticed from the relief valve. Record this as the opening differential pressure of the relief valve.

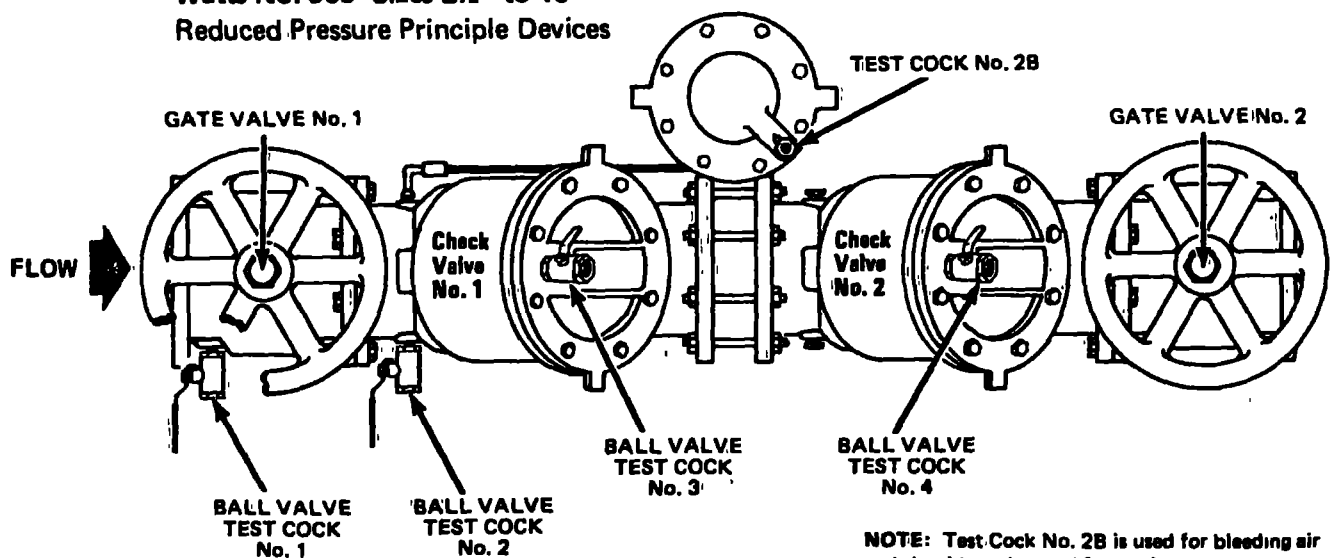
NOTE: It is important that the differential gauge needle drops slowly.

Close Test Cocks Nos. 2 and 3. Use "Vent" Hose to relieve pressure from test kit by opening valves (A), (B) and (C). Remove all test equipment and open No. 2 gate valve of the device.

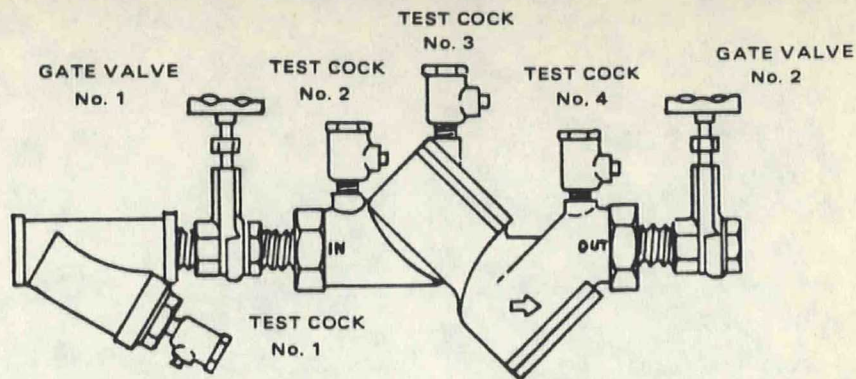
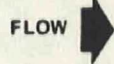
Watts No. 900 Sizes ¾" to 2"
Reduced Pressure Principle Backflow Preventer



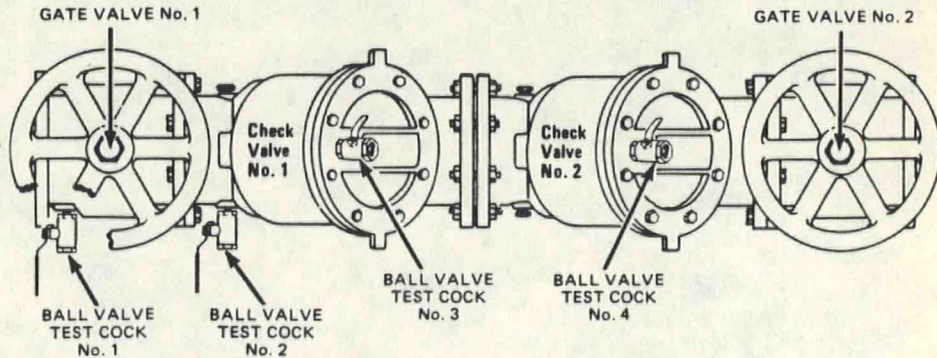
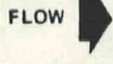
Watts No. 909 Sizes 2½" to 10"
Reduced Pressure Principle Devices



Watts No. 709
Sizes ¾" to 2"
Double Check Valve Assembly



Watts No. 709
Sizes 2½" to 10"
Double Check Valve Assembly



TEST PROCEDURE Double Check Valves

TESTING OF NO. 1 CHECK VALVE

STEP NO. 1 Close No. 1 and No. 2 gate valves.

STEP NO. 2 Open test cocks No. 2, 3 and 4. Verify that No. 1 gate valve is holding tight by observing that the discharge of water from test cock No. 2 stops.

STEP NO. 3 Attach test kit "Vent" hose to No. 1 test cock; "Low" hose to No. 2 test cock and "High" hose to No. 3 test cock. At this point valves (A) and (C) should be open and (B) should be closed.

STEP NO. 4 Close test cock No. 4.

STEP NO. 5 Open test cock No. 1. The needle on the differential gauge will indicate a pressure in excess of 15 PSID.

STEP NO. 6 Slowly open needle valve (B) until the differential gauge reads 10 PSID. Then close (B). The gauge reading will not change if No. 1 check is holding tight. If No. 1 check is leaking, the gauge will drop to 0.

TESTING OF NO. 2 CHECK VALVE

STEP NO. 1 Close test cock No. 1.

STEP NO. 2 Open test cock No. 4.

STEP NO. 3 Change "Low" hose from test cock No. 2 to test cock No. 3. Change "High" hose from test cock No. 3 to test cock No. 4. On the test kit, valves (A) and (C) should be open and valve (B) should be closed.

STEP NO. 4 Open test cock No. 1. The pressure differential gauge will indicate a pressure in excess of 15 PSID.

STEP NO. 5 Slowly open needle valve (B) until the gauge reads 10 PSID, then close. If the gauge reading does not change, No. 2 check valve is holding tight. If No. 2 check is leaking, the gauge will drop to 0.

NOTE in the above testing: minor leakage in gate valve No. 2 will not affect the test results. However, in testing the No. 1 check, leaking No. 1 gate valve would cause a good first check to fail the test.



HEADQTRS:
 Box 628, Lawrence, MA 01842 (617) 688-1811
 Telex: 94-7460 Watts Reg Low
International Subsidiaries:
 Watts Regulator of Canada Ltd. Telex: 06527137
 Watts Regulator (Nederland) b.v. Telex: 43786

LIMITED WARRANTY: Watts Regulator Company warrants each product against defects in material and workmanship for a period of one year from the date of original shipment. In the event of such defects within the warranty period, the Company will, at its option, replace or recondition the product without charge. This shall constitute the exclusive remedy for breach of warranty, and the Company shall not be responsible for any incidental or consequential damages, including, without limitation, damages or other costs resulting from labor charges, delays, vandalism, negligence, fouling caused by foreign material, damage from adverse water conditions, chemicals, or any other circumstances over which the Company has no control. This warranty shall be invalidated by any abuse, misuse, misapplication or improper installation of the product. **THE COMPANY MAKES NO OTHER WARRANTIES EXPRESS OR IMPLIED EXCEPT AS PROVIDED IN THIS LIMITED WARRANTY.**

4112-CUSH 4112H-CUSH
4113-CUSH 4113H-CUSH
4114-CUSH 4114H-CUSH
4115-CUSH 4115H-CUSH

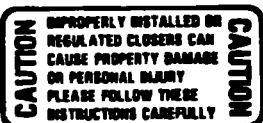
LCN CLOSERS

Part of worldwide Ingersoll-Rand

INSTRUCTIONS FOR CUSH-N-STOP STOP FACE MOUNTED

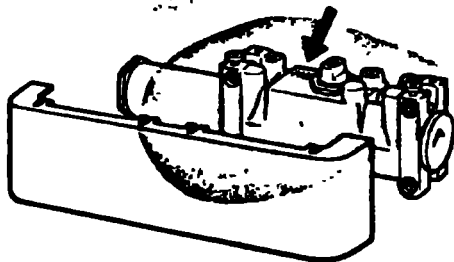
This Side of Sheet for a
RIGHT HAND Closer
on a **RIGHT HAND Door**

(See Other Side for Left Hand Closer on Left Hand Door)



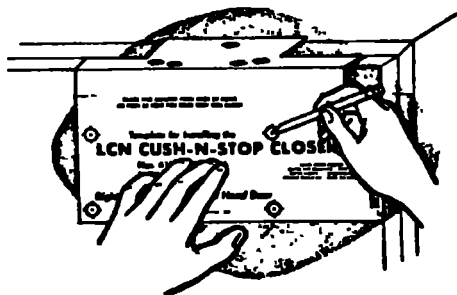
INSTALLATION

- 1** Remove cover. Hand of closer must match hand of door. If door is **RIGHT HAND**, letters "RH" on closer must appear in line with three regulating screws (as shown below). Hand of closer cannot be reversed.

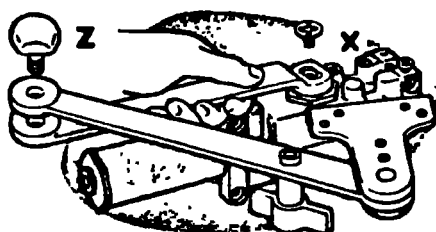


This is a Right Hand Door
Closer Mounts on
STOP FACE of Door

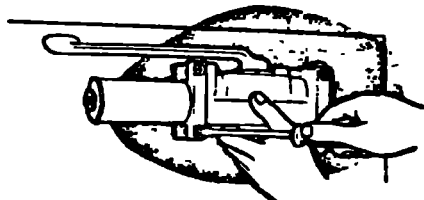
- 2** Locate screw holes. Using Template Card and **MAKING SURE CARD** IS FOLDED if necessary **FOR THE CORRECT DEGREE OF OPENING REQUIRED** place card against hinge stop and head stop. Mark spots for screw holes on face of door and head stop. Drill holes.



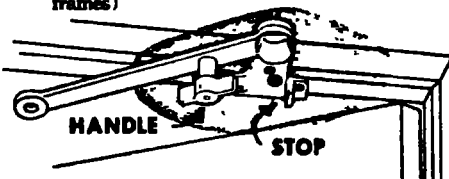
- 3** Remove stud Z at junction of arm. Place main arm on shaft and push down into position. Install screw X.



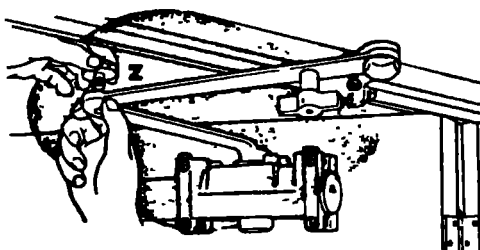
- 4** Mount closer on door and shore on head stop (A drop plate is available for use on doors having shallow top rails.)



Installer should provide a spacer the same thickness as the stop for the fifth screw of the parallel arm shoe (Special Jamb Bracket available from LCN for use with narrow frames)

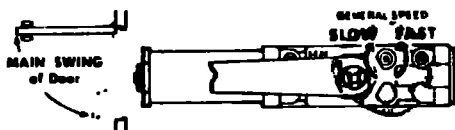


- 5** Swing door open about 45°; join main arm and forearm as shown, and insert stud Z. **TIGHTEN SECURELY.**



IMPORTANT

- 6** **REGULATION**—Do not allow door to slam into frame. A "normal" closing time from 90° open position is 5 to 7 seconds. Use socket screw key furnished. To slow **MAIN SWING SPEED** of door, turn regulating screw (nearest arm) clockwise.



To slow **LATCH SPEED** of door, turn regulating screw (nearest hinge) clockwise.

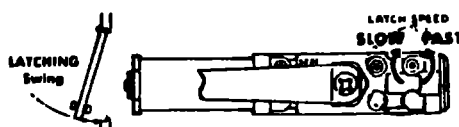


TABLE OF SIZES		
Maximum width of doors		Catalog No. of Closers
Exterior	Interior	
	2'2" (650MM)	4112-Cush
2'4" (700MM)	3'0" (900MM)	4113-Cush
3'0" (900MM)	3'8" (1100MM)	4114-Cush
3'6" (1050MM)	4'6" (1350MM)	4115-Cush
4'0" (1200MM)	5'0" (1500MM)	4116-Cush

NOTE Specify next higher size closer where strong drafts exist.

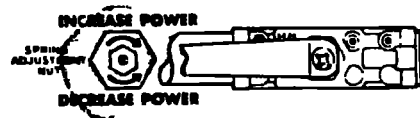
- 7** To increase **BACK-CHECK**, turn regulating screw (nearest latch) clockwise. Use lightest **BACK-CHECK** that will retard door opening sufficiently. Do not use an **ABRUPT BACK-CHECK**, nor expect door closer to act as a door stop.



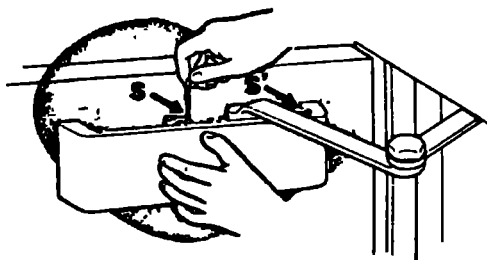
BACKCHECK



- 8** Adjust **CLOSING POWER** only if more power is needed. To increase **CLOSING POWER** turn spring adjusting nut clockwise. Maximum adjustment, 6 turns.

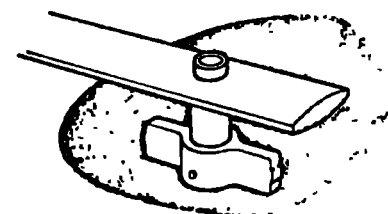


Replace cover, and push it against door while tightening screws S and S'. **DO NOT OVERTIGHTEN SCREWS**



9 HOLD-OPEN TYPE

A quarter turn on the control handle engages or disengages **HOLD-OPEN**



10 NON HOLD-OPEN TYPE

Serves as stop only.



FILE INFORMATION:
DIVISION TAB - TRANE HEATING
PRODUCTS
PRODUCT TAB - UNIT HEATERS
MODEL TAB - GAS FIRED
LITERATURE ITEM - Unit Wiring

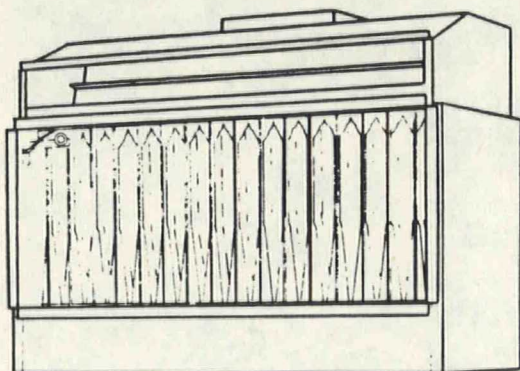
LITERATURE FILE NO.

GDNC-W-1

UNIT WIRING

Since the Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.

JULY 1982



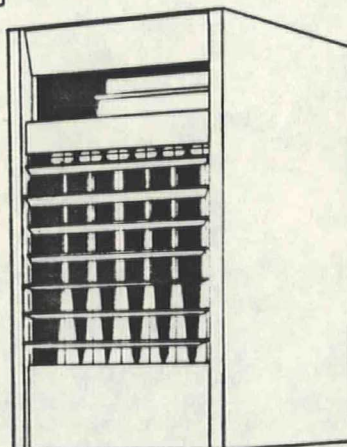
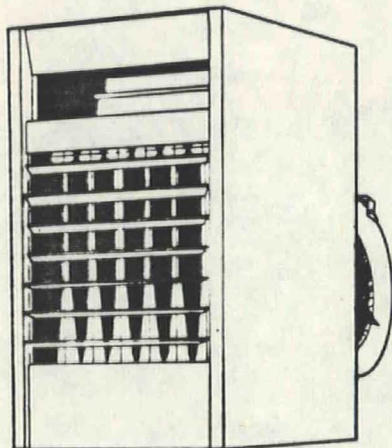
INDOOR GAS UNIT HEATERS AND DUCT FURNACES

MODELS

GPNC/GPPC-003 THRU 040
GCNC/GCPC-005 THRU 040
GDNC/GDPC-005 THRU 040

DESIGN SEQUENCE A

NOTE: Hydraulic modulation gas control shown in this manual consists of a mechanically operated valve (not illustrated) in series with a single stage electrically operated valve.



CAUTION: THE WIRING DIAGRAMS GIVEN IN THIS BOOKLET ARE TYPICAL AND ACTUAL WIRING OF YOUR UNIT MAY DIFFER. TO PREVENT DAMAGE TO UNIT, REFER TO THE "AS WIRED" DIAGRAMS PROVIDED WITH THE UNIT FOR SPECIFIC INFORMATION.

CAUTION: USE COPPER CONDUCTORS ONLY - UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPE WIRING. THE USE OF ALUMINUM WIRING MAY CAUSE GALVANIC CORROSION AND/OR OVERHEATING AT THE CONNECTION POINTS WITH RESULTANT EQUIPMENT FAILURE.

TABLE OF CONTENTS

PROPELLER AND CENTRIFUGAL FAN UNIT HEATERS	
Standing Pilot Ignition	3
Intermittent Pilot Ignition	6
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Standing Pilot Ignition	9
Intermittent Pilot Ignition	12
INDOOR DUCT FURNACES	
Standing Pilot Ignition	15
Intermittent Pilot Ignition	28

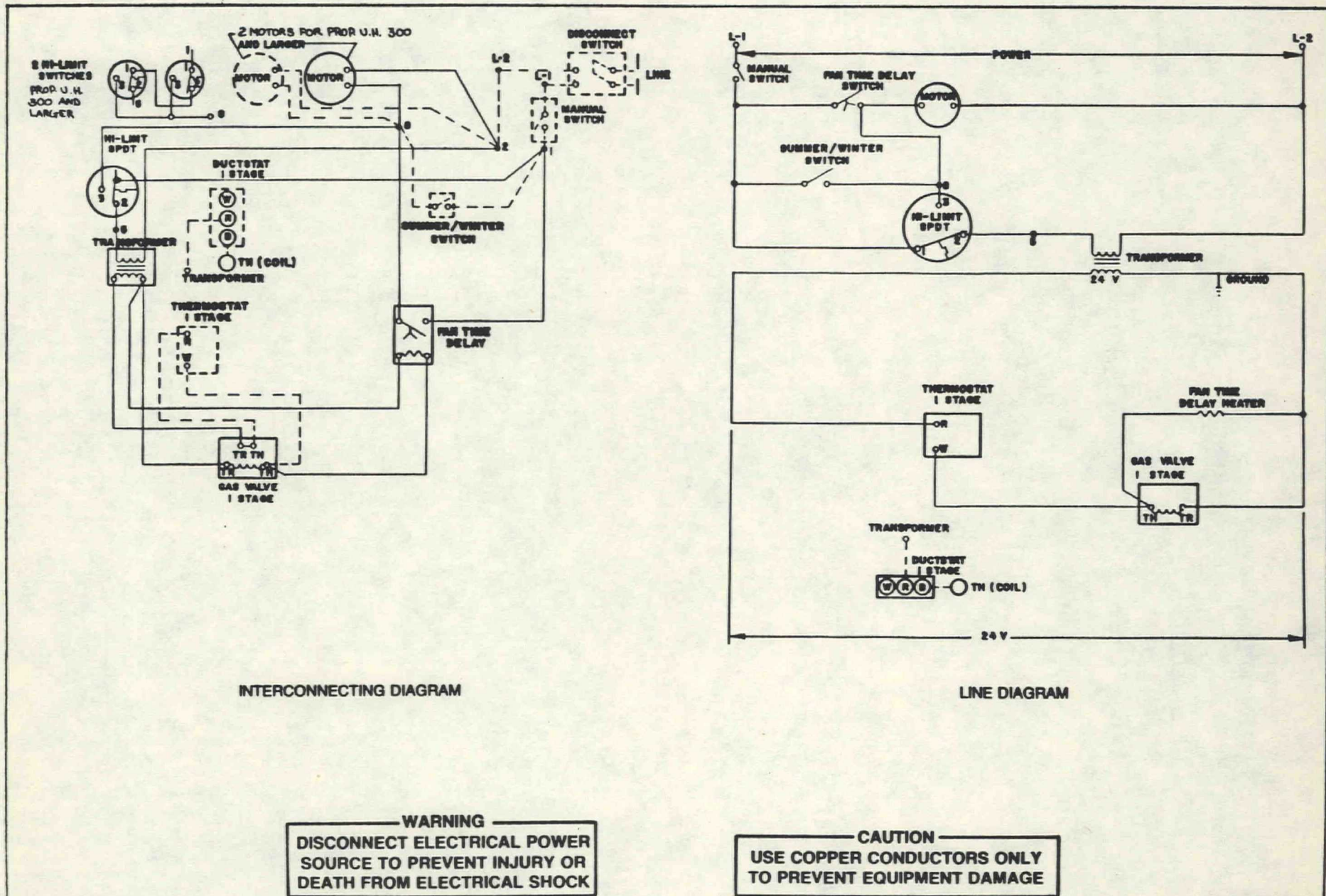
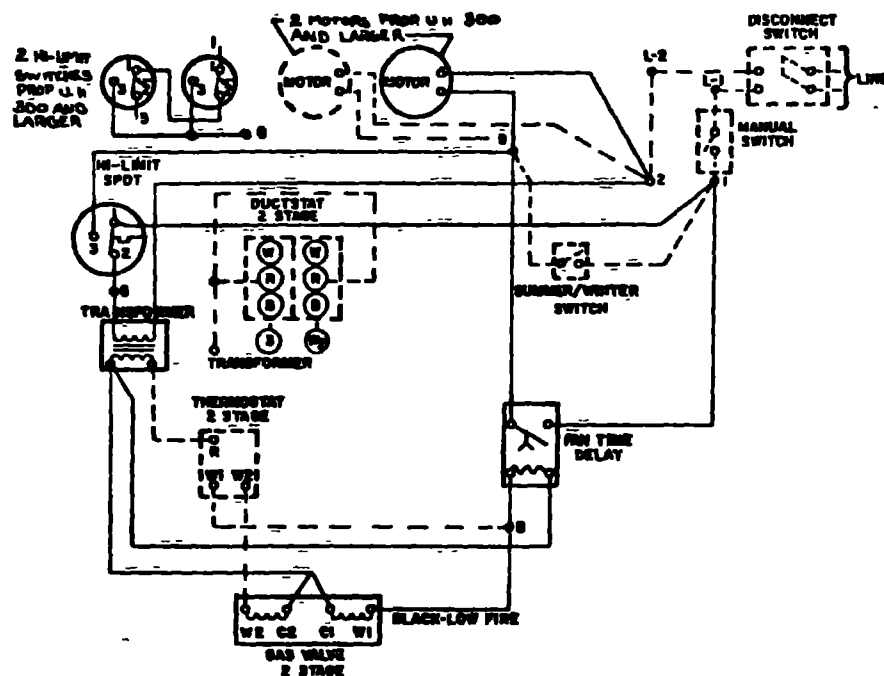


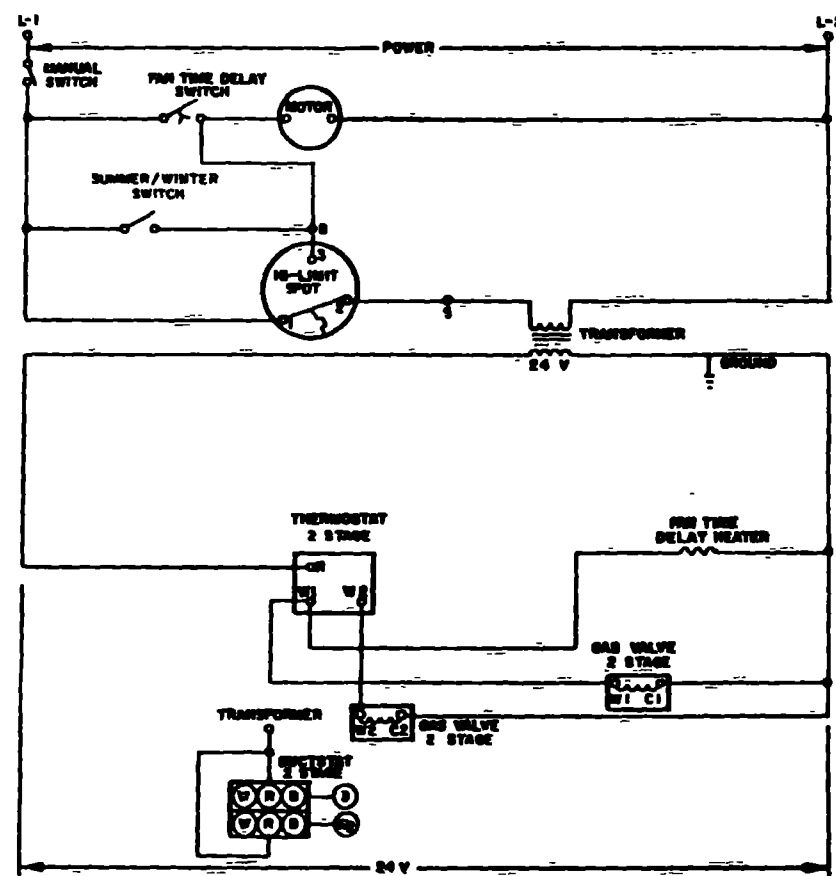
FIGURE 1 - Propeller and Centrifugal Fan Unit Heater, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, 115-230/60/1, Natural or LP Gas

GPNC-S/W-2



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

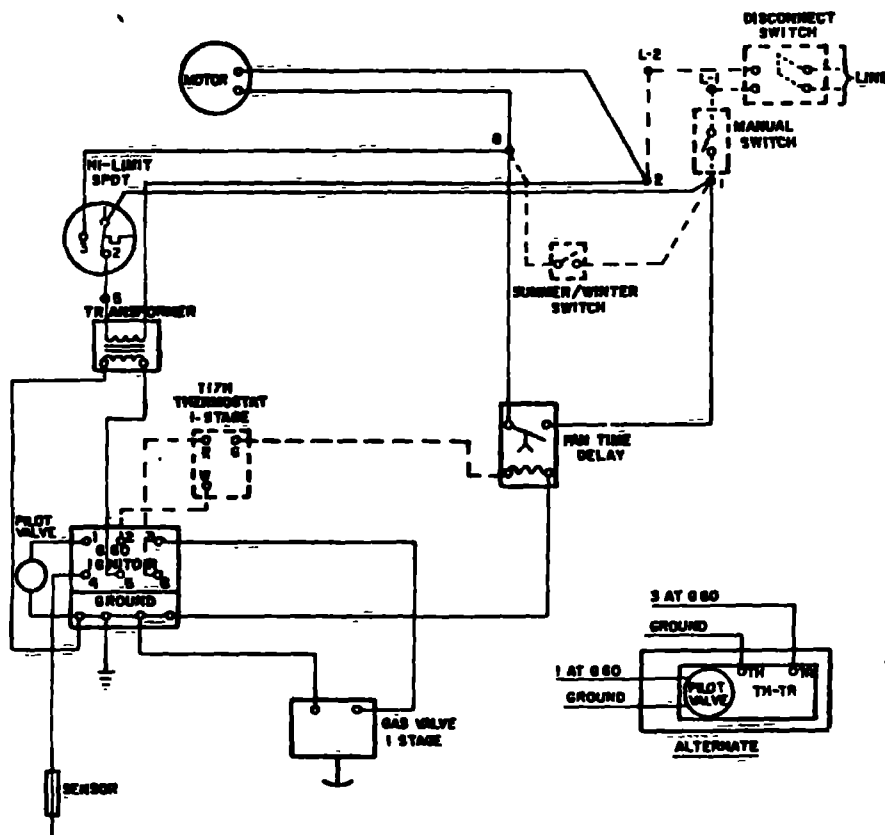


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

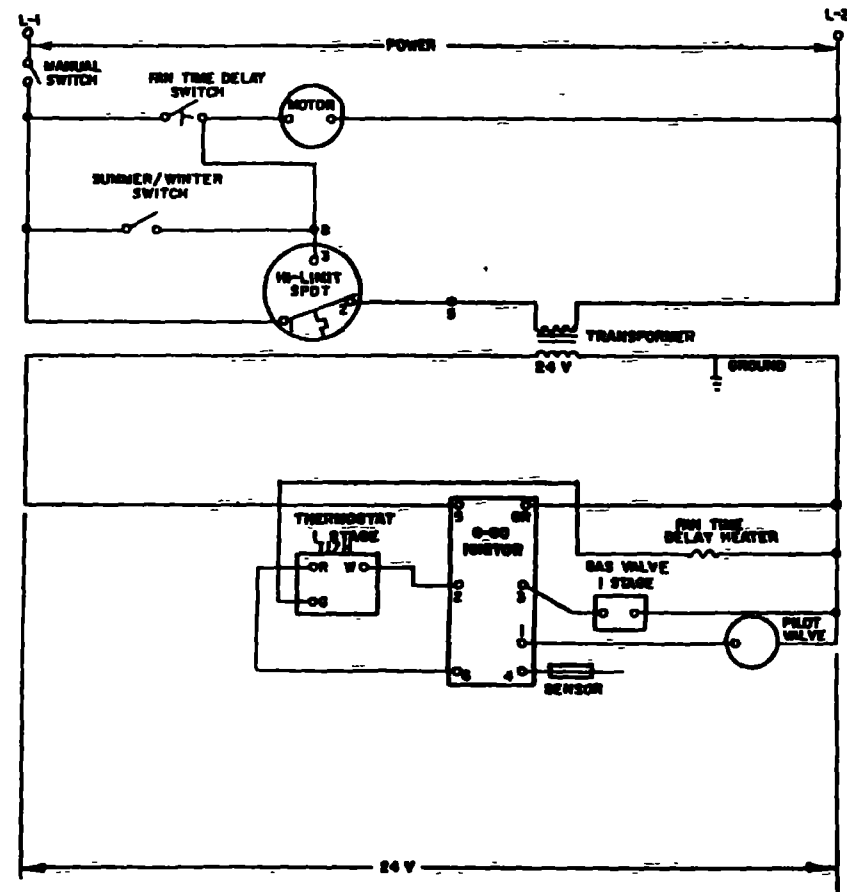
FIGURE 3 - Propeller and Centrifugal Fan Unit Heater, Standing Pilot Ignition, Two Stage Gas Control, 115-230/60/1, Natural or LP Gas

GPNC-8/W-4



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

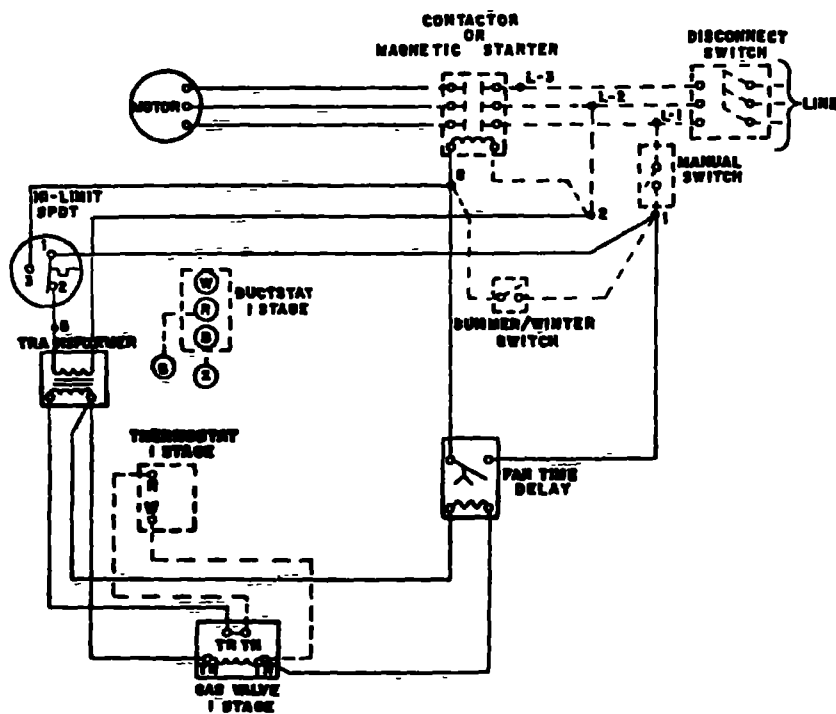


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

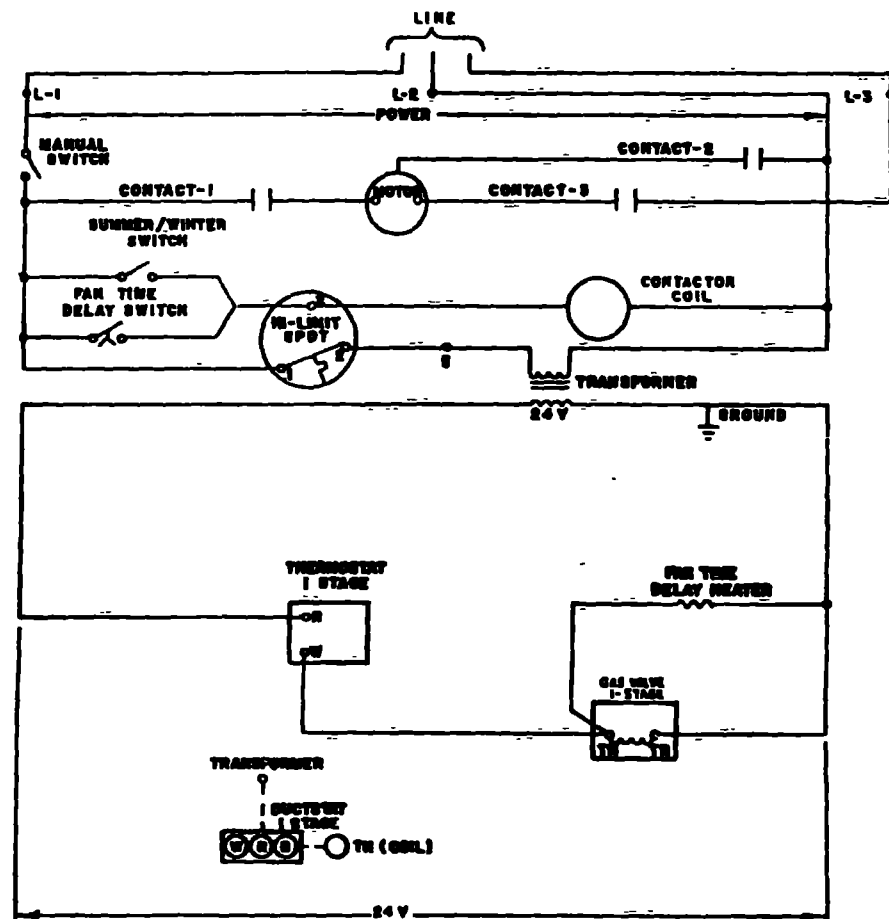
FIGURE 5 - Propeller and Centrifugal Fan Unit Heater, Intermittent Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Thermostat with Fan Switch, 115-230/80/1, Natural Gas

GPNC-S/W-6



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

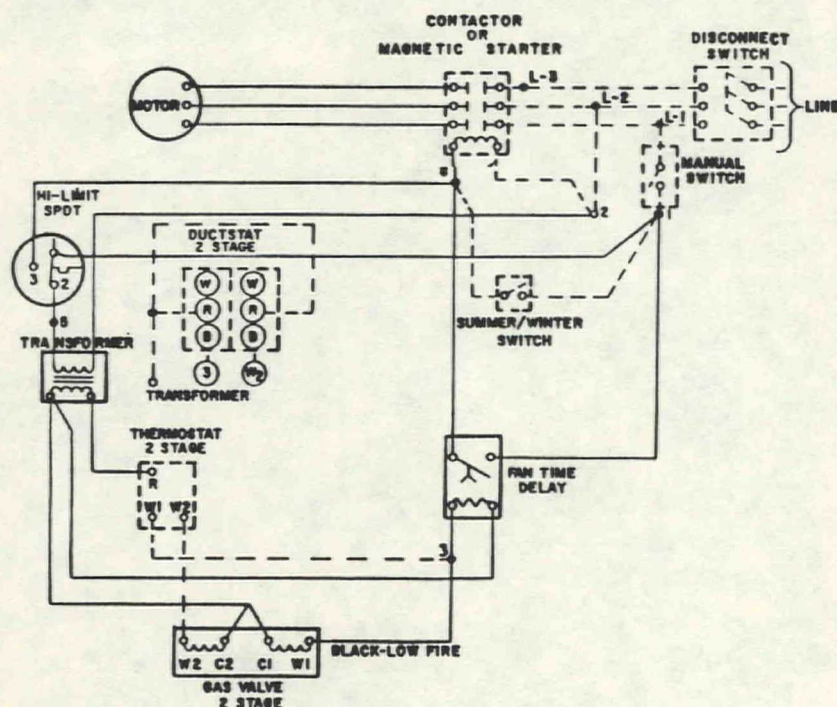


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

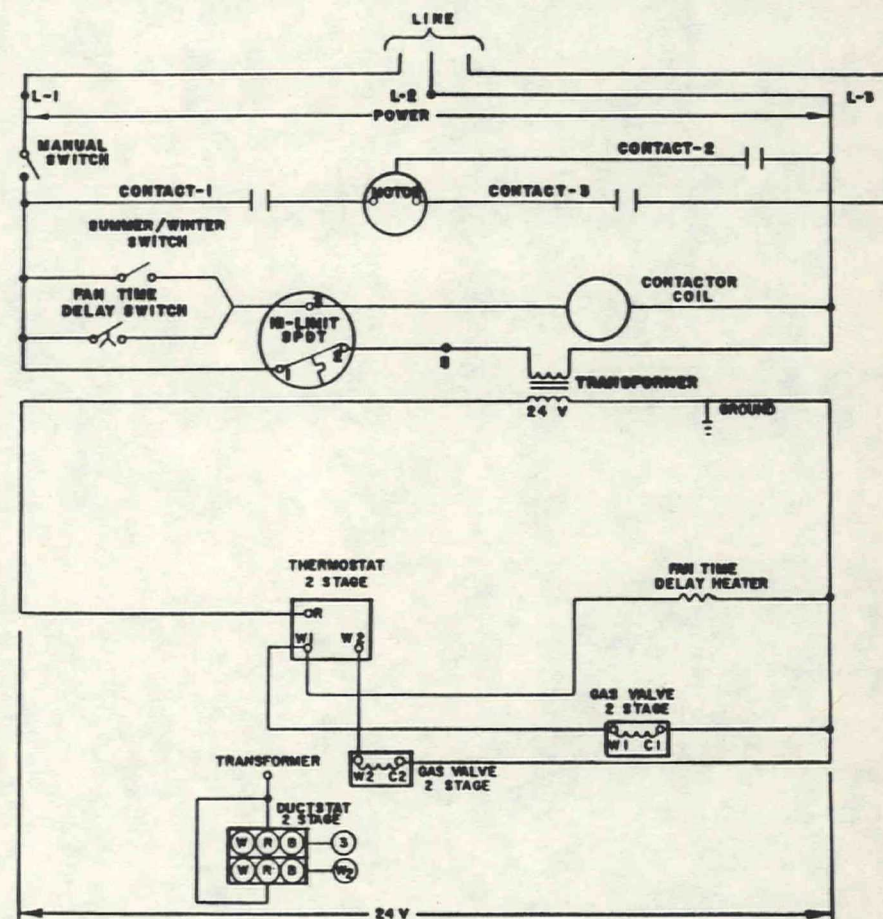
GCNC-8/W-2

FIGURE 7 - Centrifugal Fan Unit Heater, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, 208-230/60/3, Natural or LP Gas



INTERCONNECTING DIAGRAM

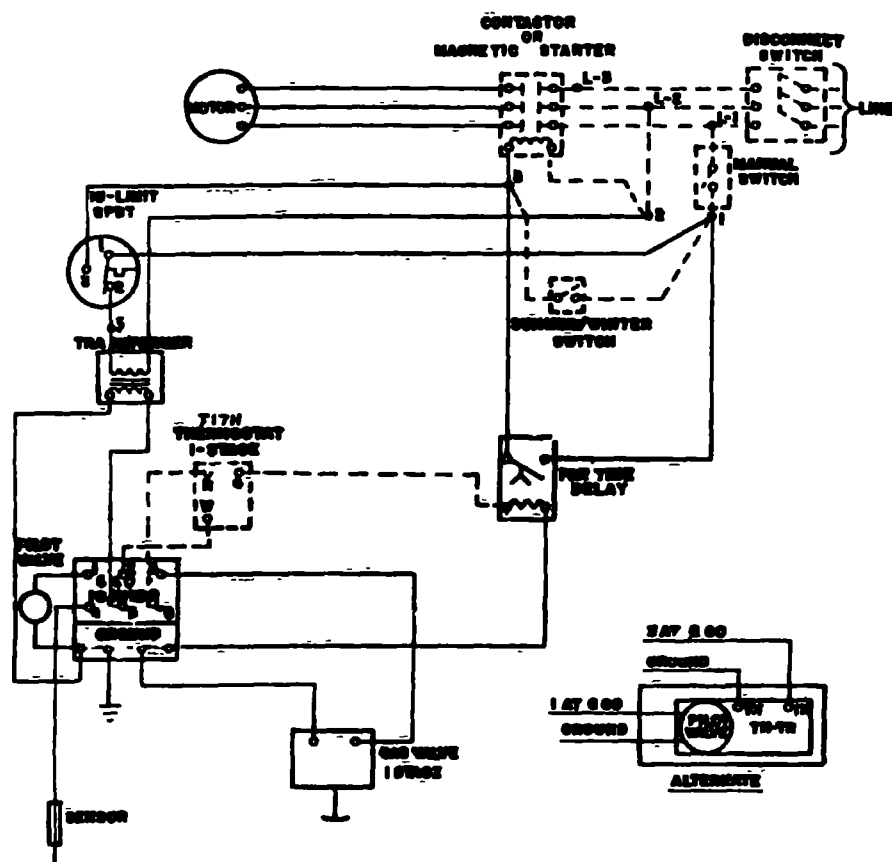
WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK



LINE DIAGRAM

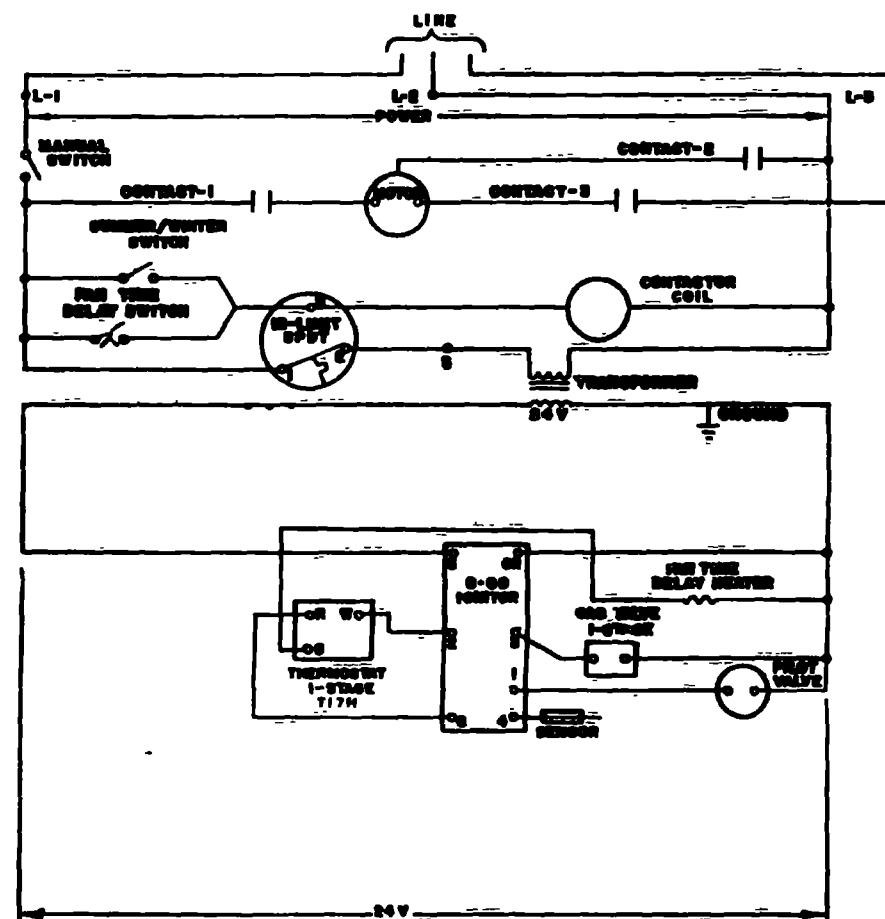
CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

FIGURE 9 - Centrifugal Fan Unit Heater, Standing Pilot Ignition, Two Stage Gas Control, 208-230/60/3, Natural or LP Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

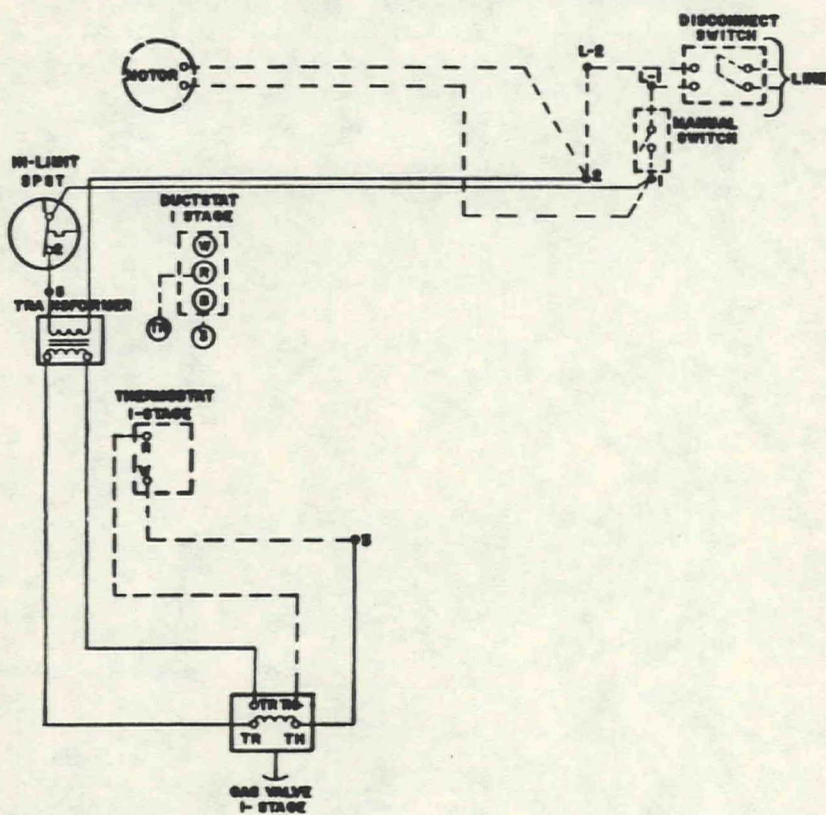


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

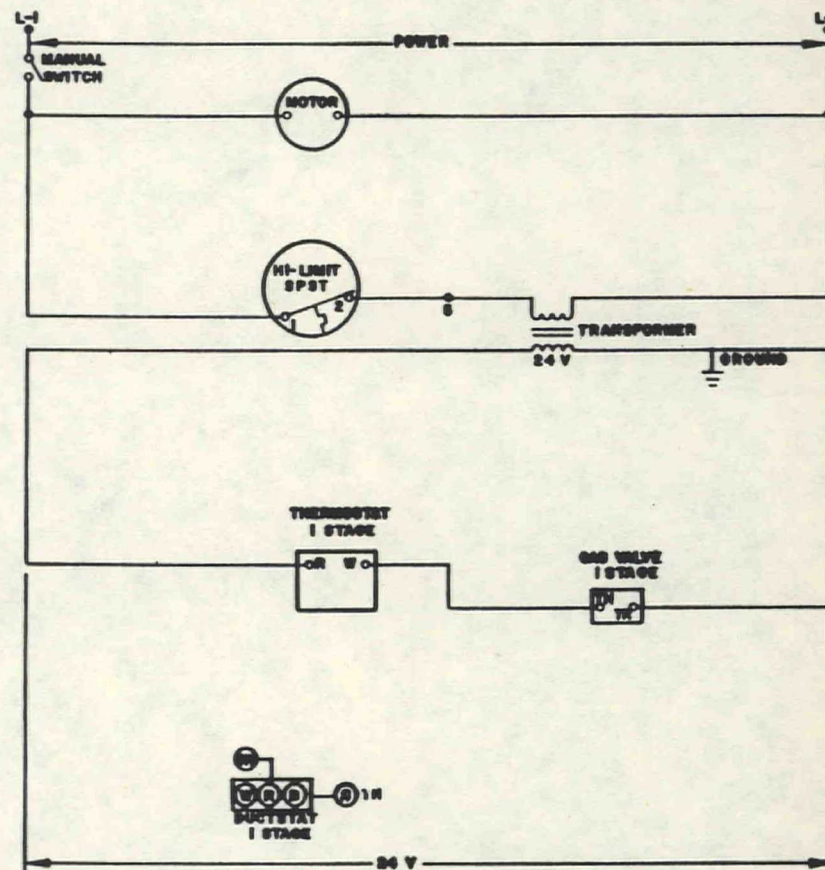
GCNC-8/W-6

FIGURE 11 - Centrifugal Fan Unit Heater, Intermittent Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Thermostat with Fan Switch, 208-230/60/3, Natural Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

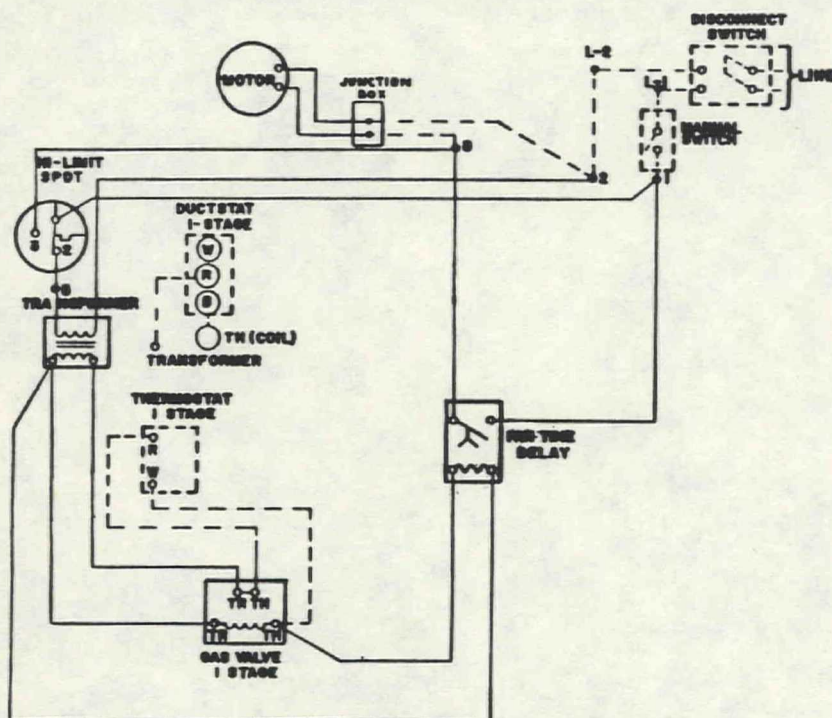


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

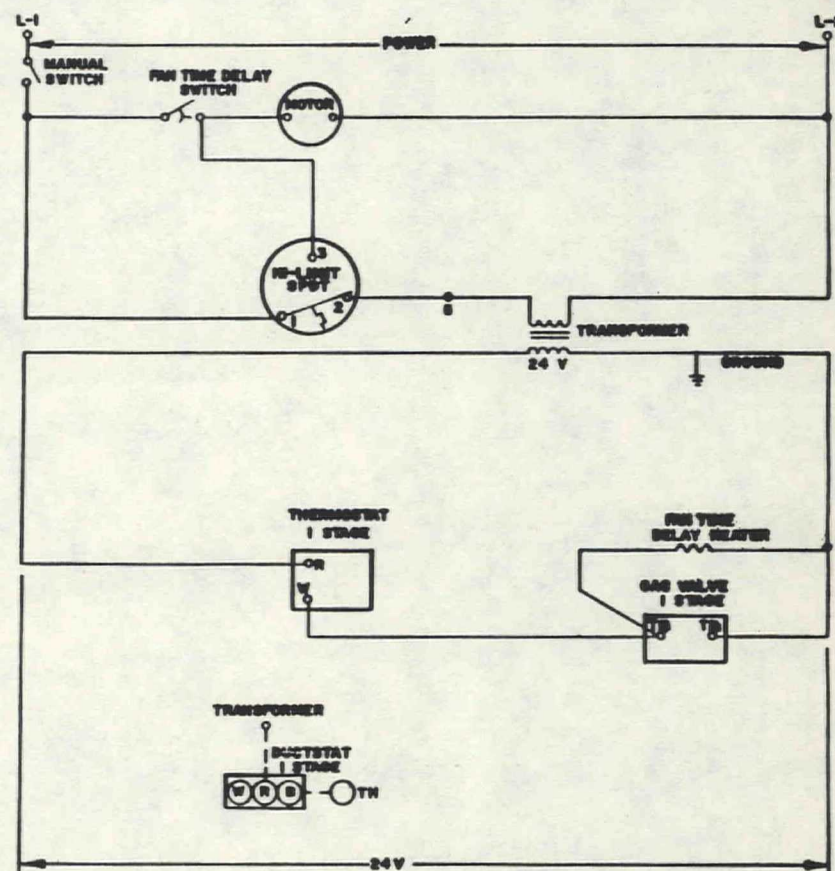
FIGURE 13 - Indoor Duct Furnace, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, 115-230/60/1, Natural or LP Gas

GDNC-S/W-2



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

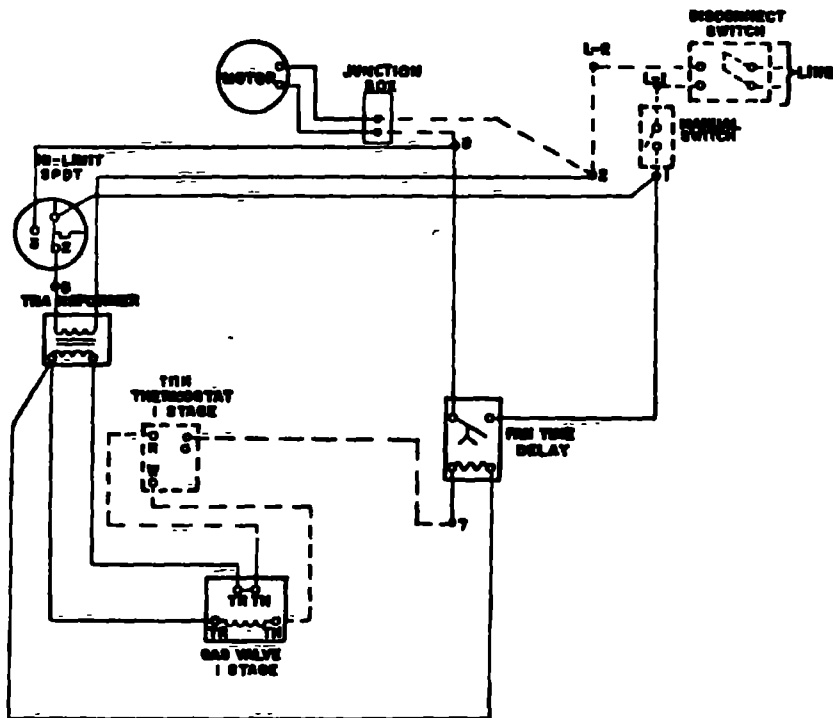


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

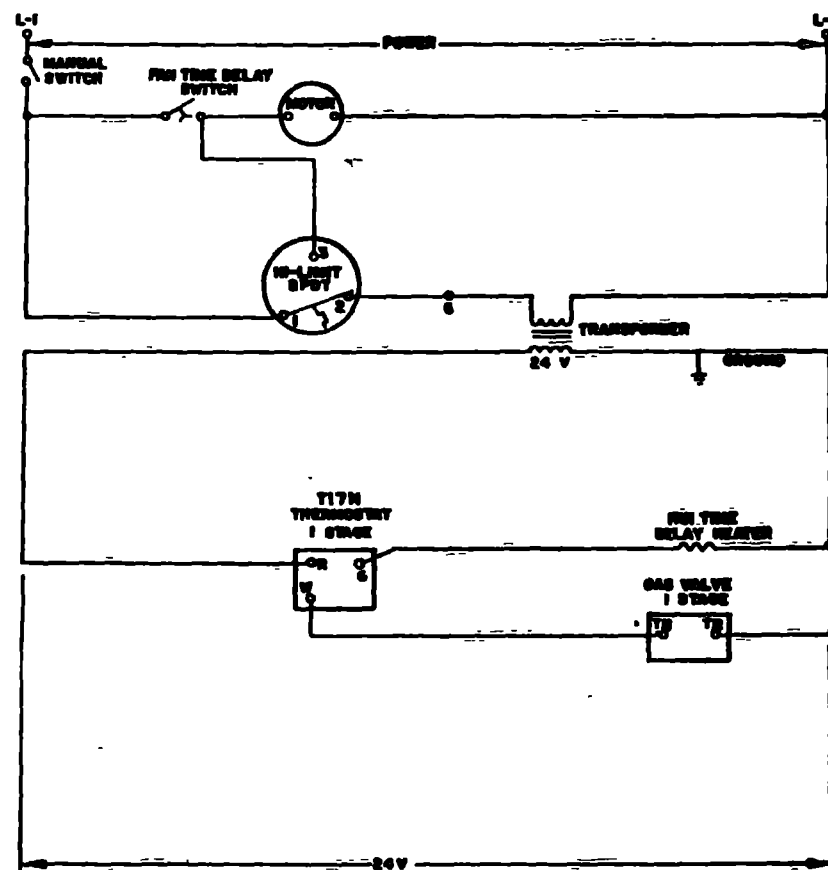
GDNC-S/W-4

FIGURE 15 - Indoor Duct Furnace, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, 115-230/60/1, Natural or LP Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

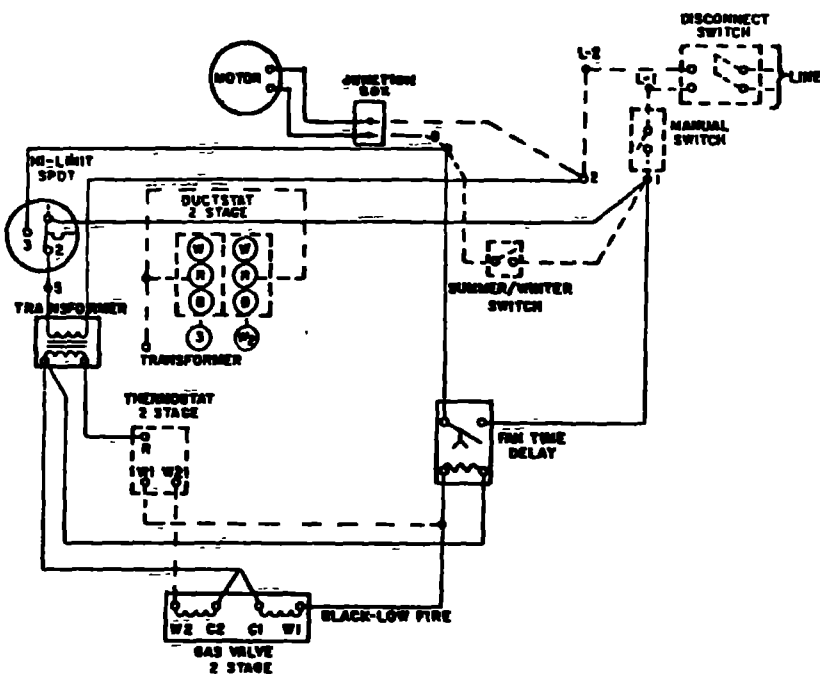


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

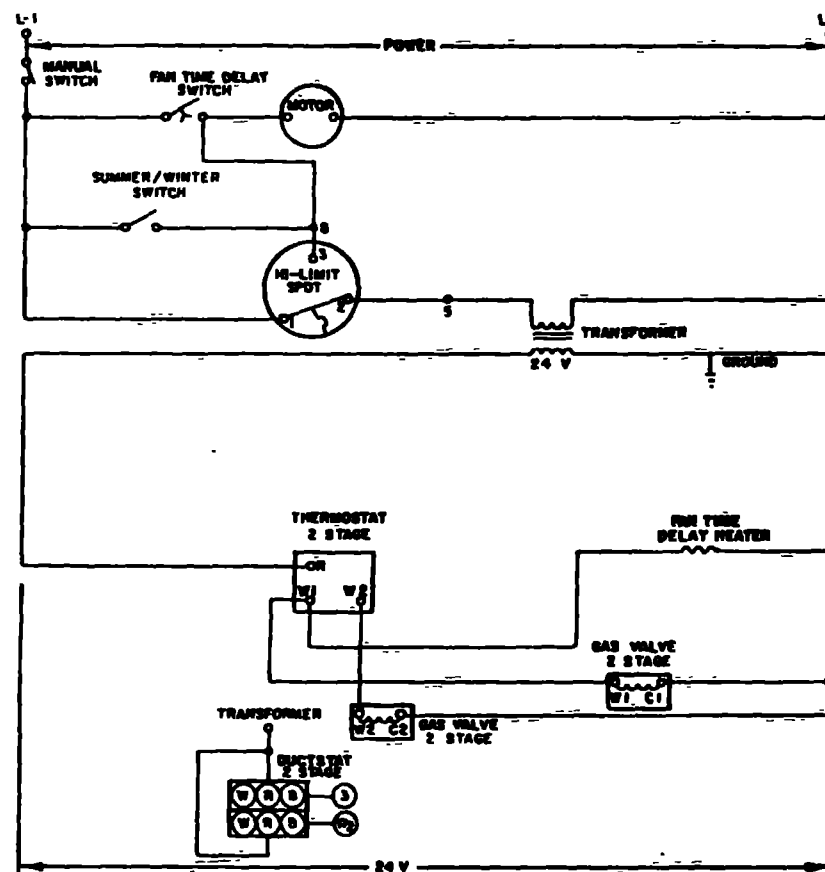
GDNC-S/W-6

FIGURE 17 - Indoor Duct Furnace, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, Thermostat with Fan Switch, 115-230/60/1, Natural or LP Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK



LINE DIAGRAM

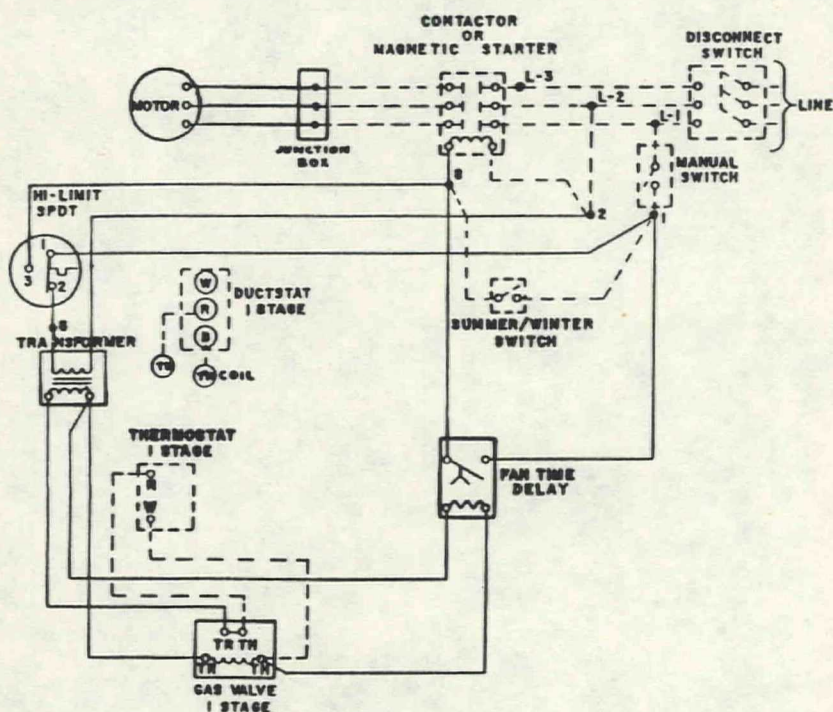
CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

FIGURE 19 - Indoor Duct Furnace, Standing Pilot Ignition, Two Stage Gas Control, Horizontal Blower Assembly, Fan Time Delay, 115-230/60/1, Natural or LP Gas

GDNC-8/W-8

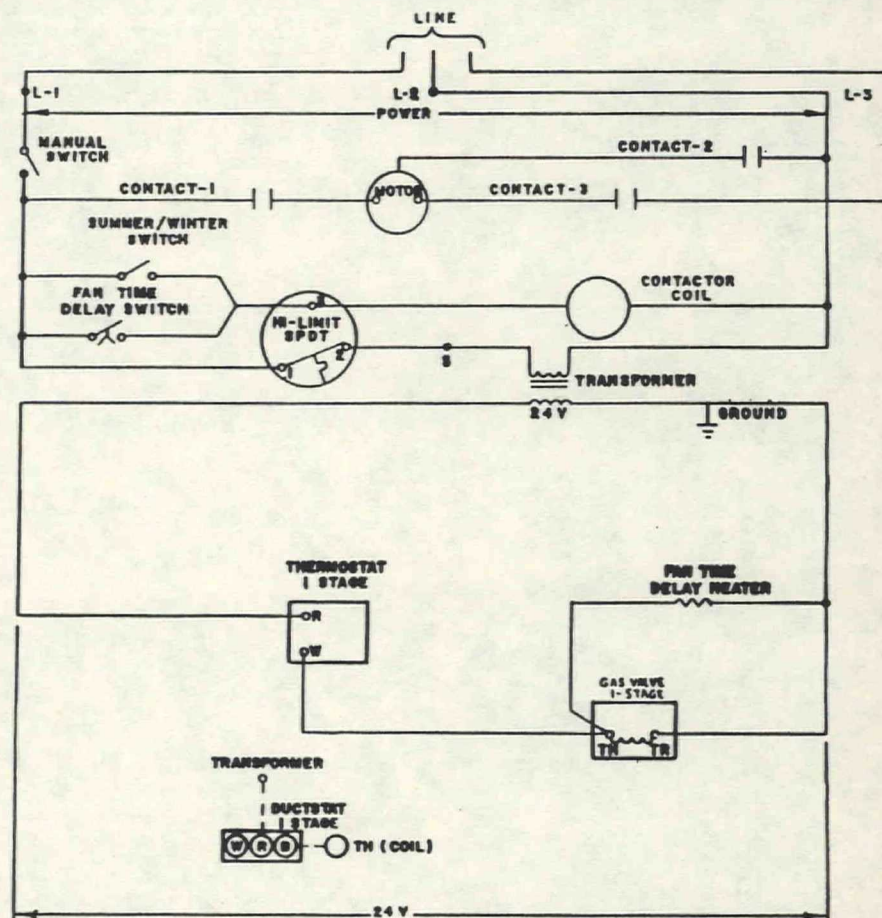
GDNC-W-1

INTERCONNECTING DIAGRAM



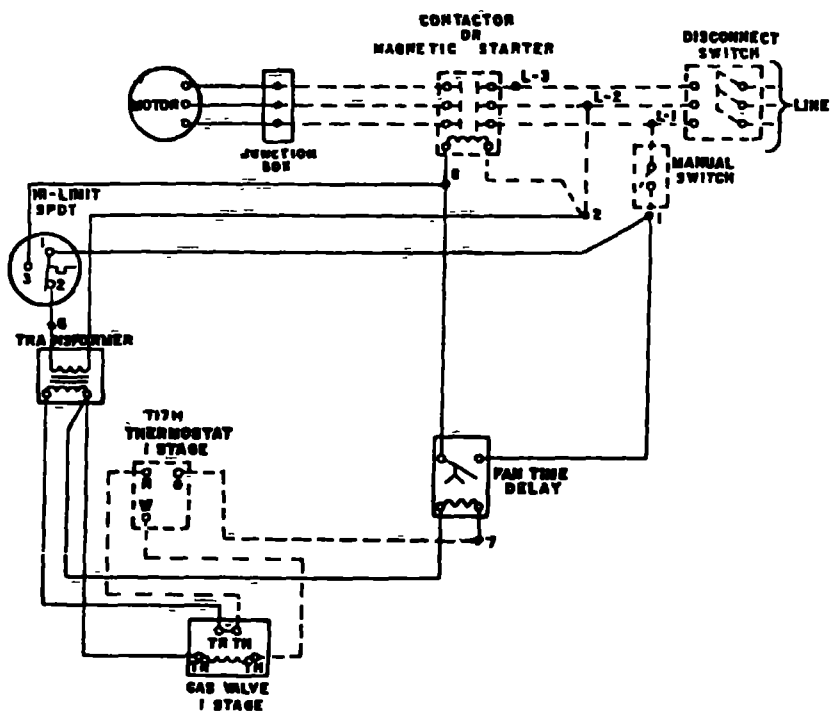
WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

LINE DIAGRAM



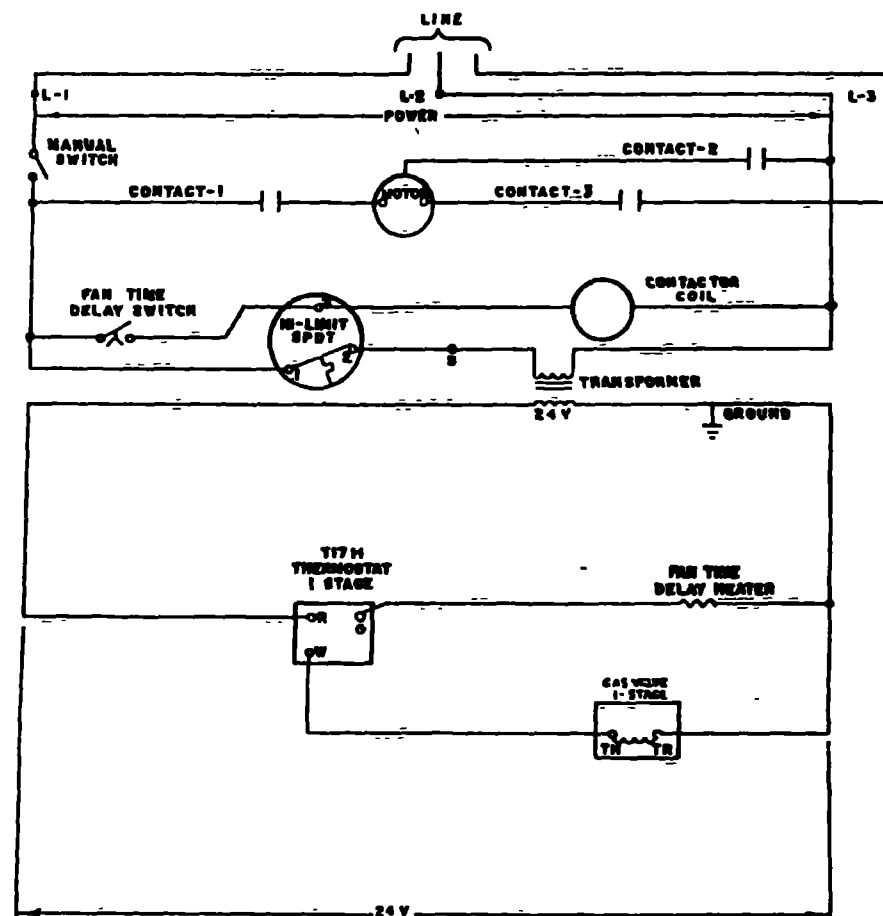
CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

FIGURE 21 - Indoor Duct Furnace, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, 208-230/60/3, Natural or LP Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

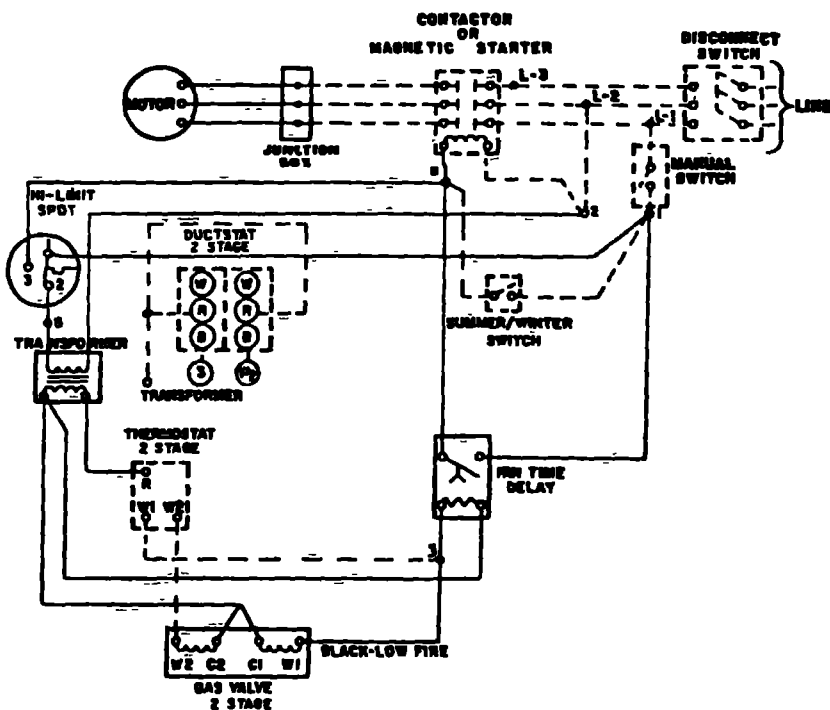


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

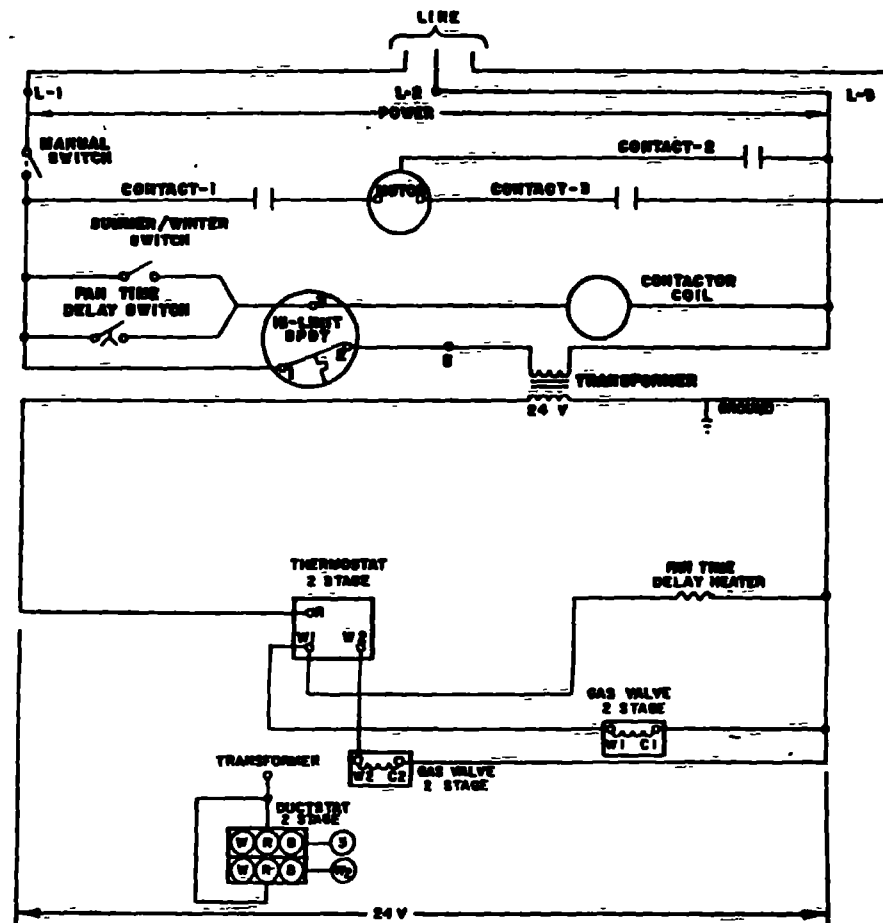
GONC-S/W-12

FIGURE 23 - Indoor Duct Furnace, Standing Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, Thermostat with Fan Switch, 208-230/60/3, Natural or LP Gas



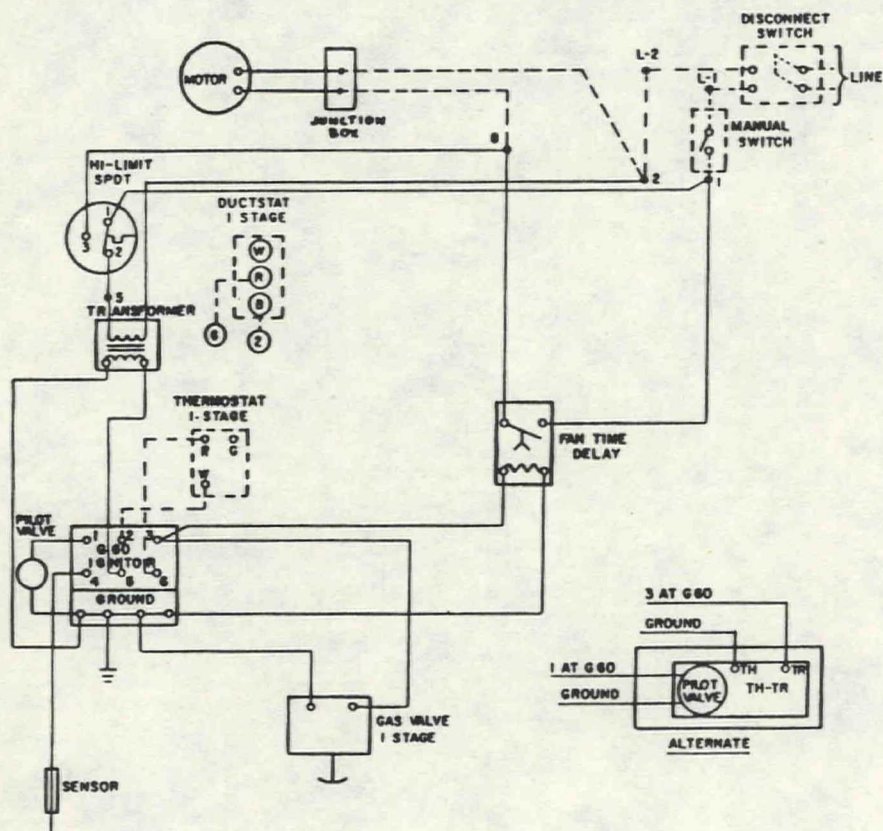
INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK



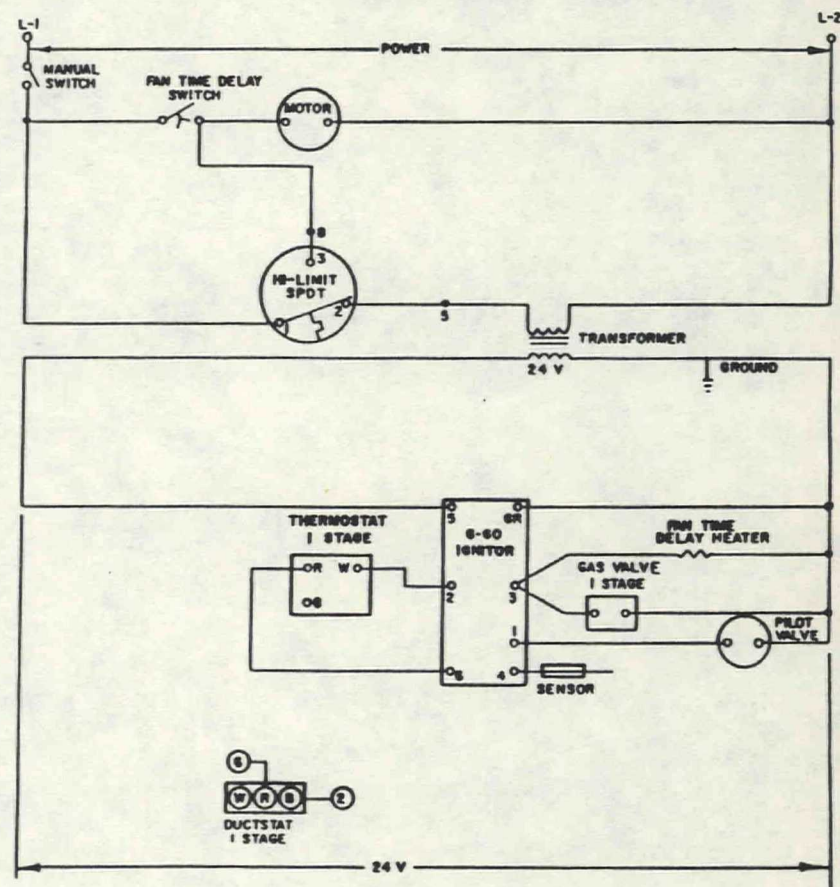
LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK

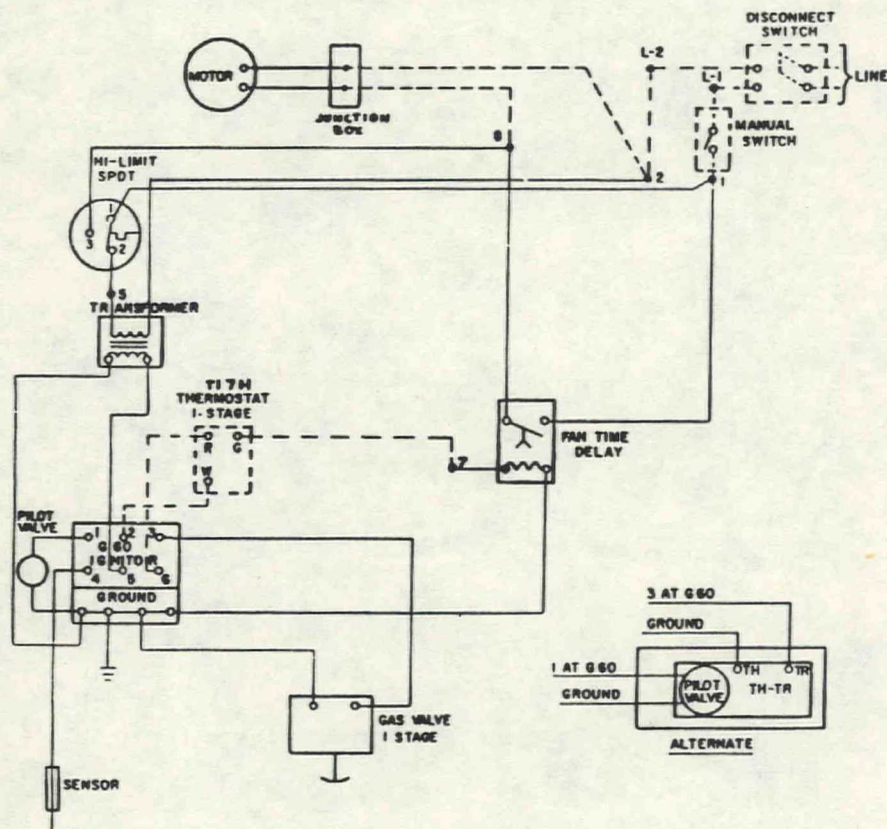


LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

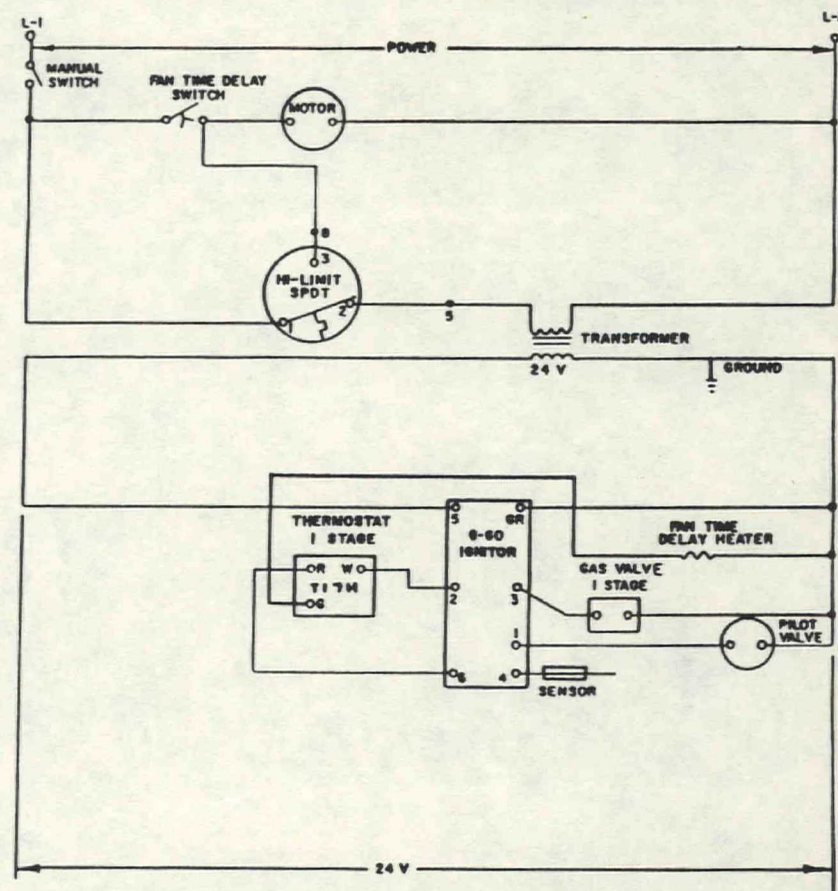
GDNC-S/W-16

Figure 27 - Indoor Duct Furnace, Intermittent Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, 115-230/60/1, Natural Gas



INTERCONNECTING DIAGRAM

WARNING
 DISCONNECT ELECTRICAL POWER
 SOURCE TO PREVENT INJURY OR
 DEATH FROM ELECTRICAL SHOCK

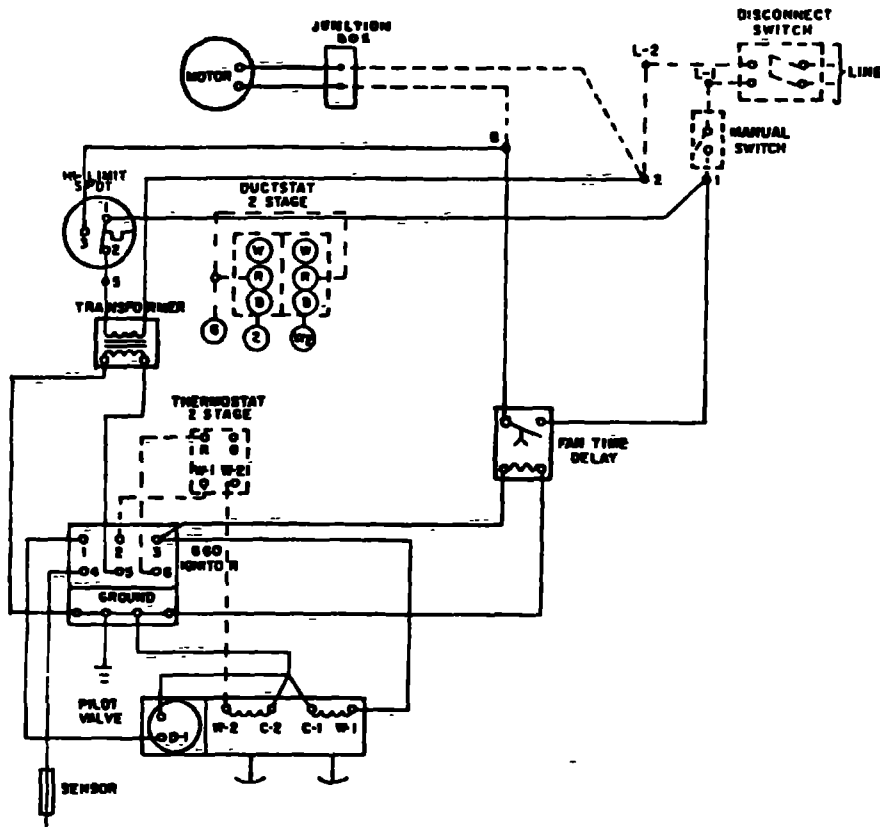


LINE DIAGRAM

CAUTION
 USE COPPER CONDUCTORS ONLY
 TO PREVENT EQUIPMENT DAMAGE

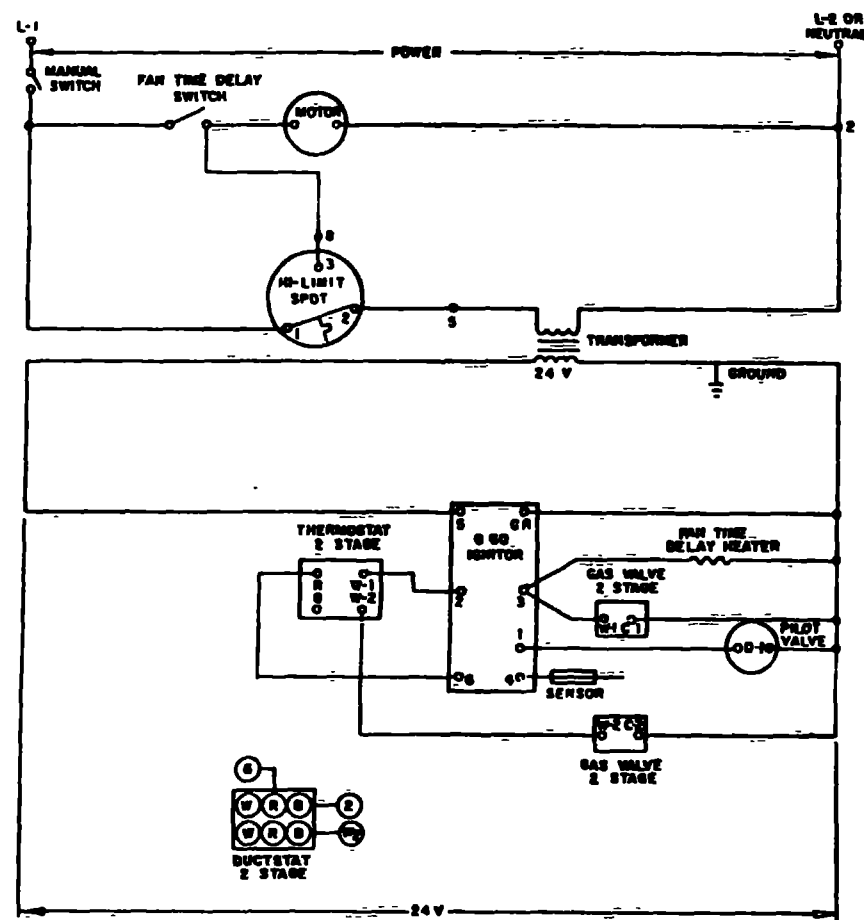
GDNC-S/W-18

FIGURE 29 - Indoor Duct Furnace, Intermittent Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, Thermostat with Fan Switch, 115-230/60/1, Natural Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK



LINE DIAGRAM

CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

GDNC-S/W-20

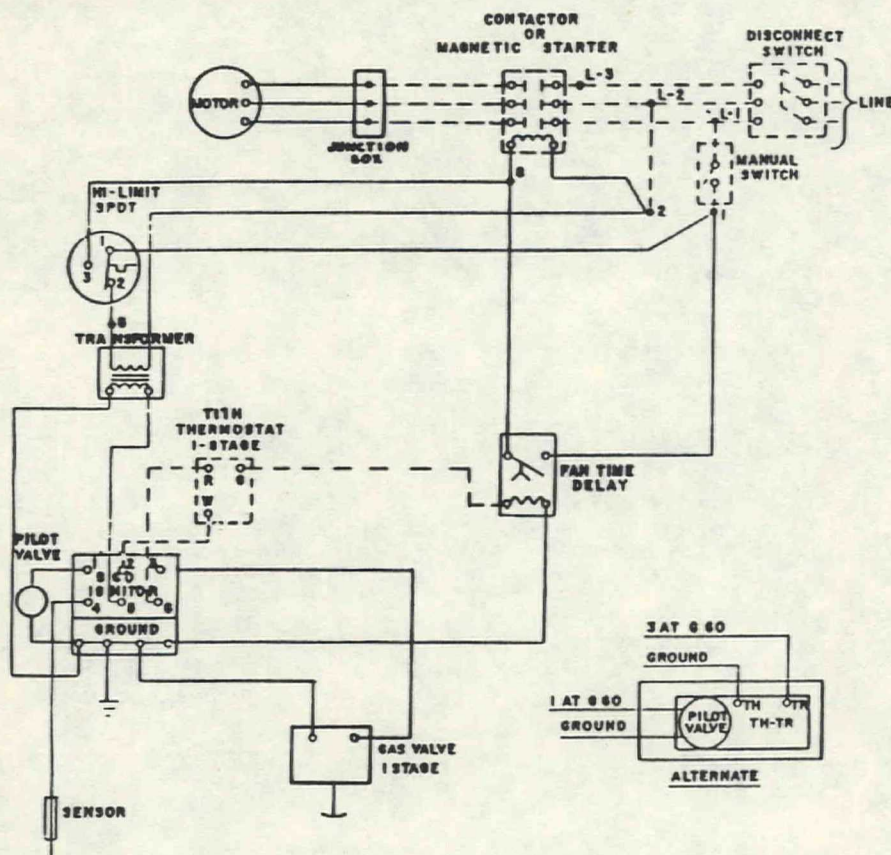
FIGURE 31 - Indoor Duct Furnace, Intermittent Pilot Ignition, Two Stage Gas Control, Horizontal Blower Assembly, Fan Time Delay, 115-230/60/1, Natural Gas



LINE DIAGRAM

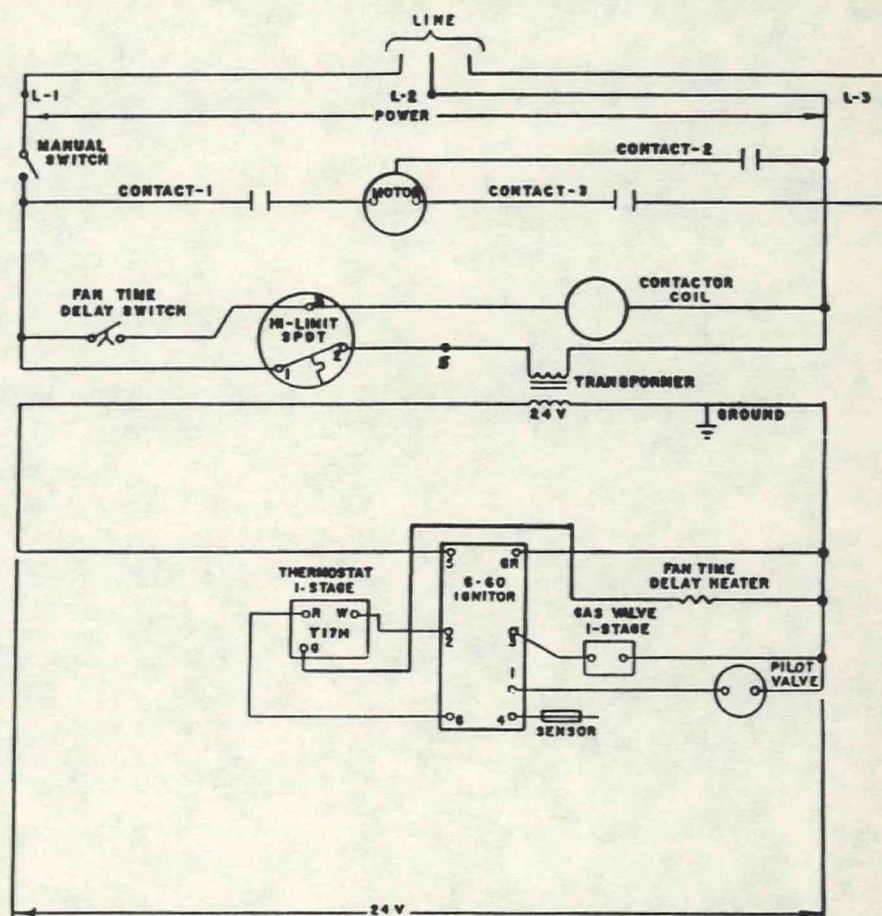
GDNC-S/W-24**GDNC-8/W-22**

FIGURE 33 - Indoor Duct Furnace, Intermittent Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Horizontal Blower Assembly, Fan Time Delay, 208-230/60/3, Natural Gas



INTERCONNECTING DIAGRAM

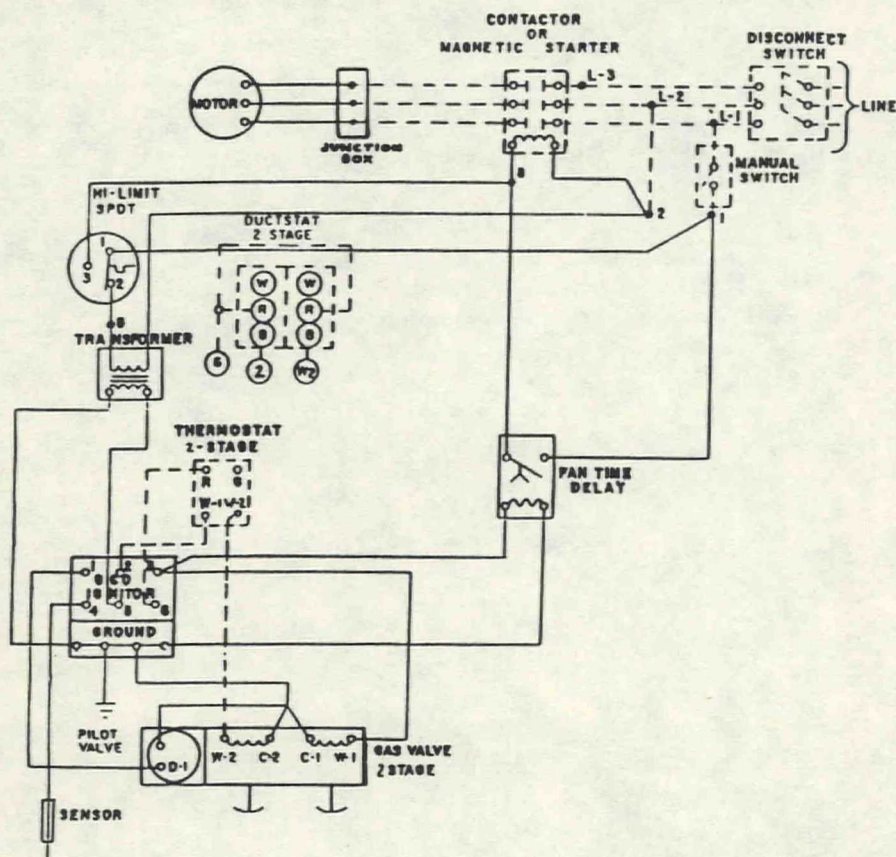
WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK



LINE DIAGRAM

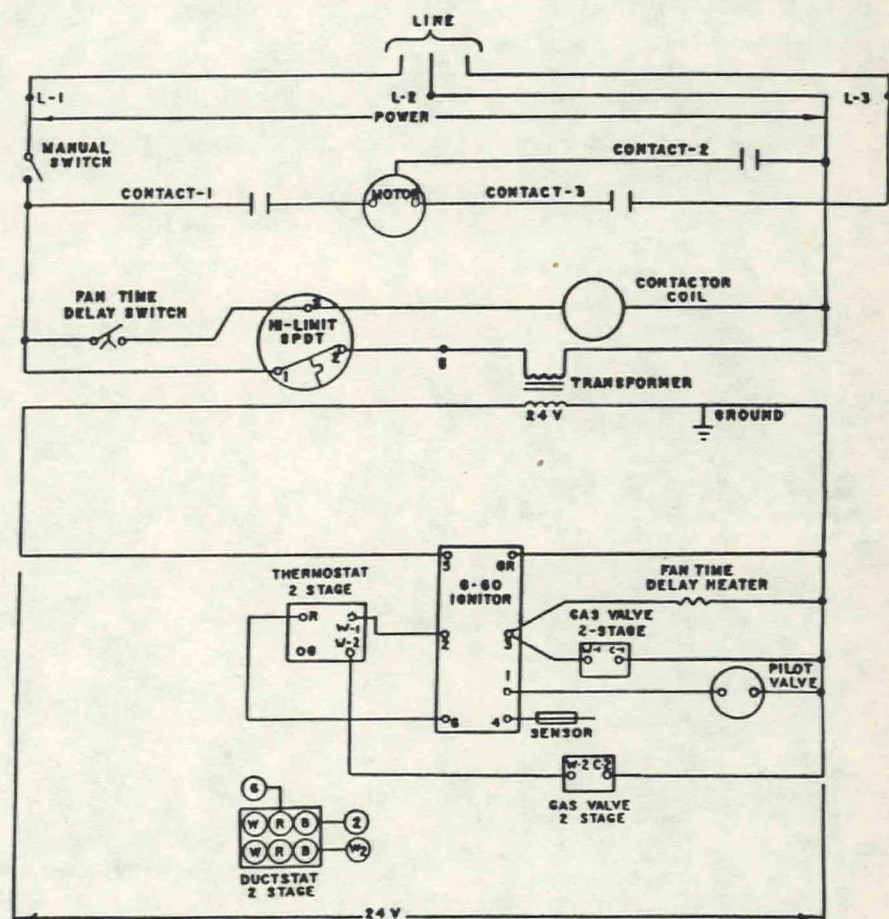
CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

FIGURE 35 - Indoor Duct Furnace, Intermittent Pilot Ignition, Single Stage or Hydraulic Modulating Gas Control, Thermostat with Fan Switch, Horizontal Blower Assembly, Fan Time Delay, 208-230/60/3, Natural Gas



INTERCONNECTING DIAGRAM

WARNING
DISCONNECT ELECTRICAL POWER
SOURCE TO PREVENT INJURY OR
DEATH FROM ELECTRICAL SHOCK



LINE DIAGRAM

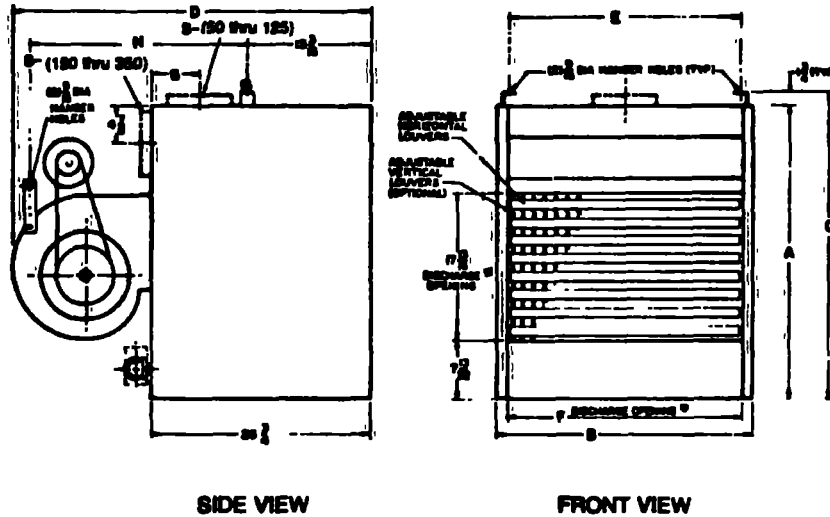
CAUTION
USE COPPER CONDUCTORS ONLY
TO PREVENT EQUIPMENT DAMAGE

FIGURE 37 - Indoor Duct Furnace, Intermittent Pilot Ignition, Two Stage Gas Control, Horizontal Blower Assembly, Fan Time Delay, 208-230/60/3, Natural Gas

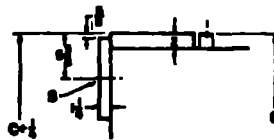
TAG

PRINT DATE	3/84	FILE NO	PL-TD-UH-GCNC-SQ-001.00	REPLACES	GCNC-SU-001.00	GCNC-SQ-001.00
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TRANE SUBMITTAL/SELECTION	CENTRIFUGAL FAN GAS UNIT HEATER		MODEL				
			<input checked="" type="checkbox"/> GCNC (NATURAL GAS)		<input type="checkbox"/> GCPC (LP GAS)		VOLTAGE <input type="checkbox"/> 115/60/1 <input type="checkbox"/> 230/60/1 <input type="checkbox"/> 208/60/3 <input type="checkbox"/> 230/60/3 <input type="checkbox"/> 460/60/3
			<input type="checkbox"/> 005 <input checked="" type="checkbox"/> 007 <input type="checkbox"/> 010 <input type="checkbox"/> 012	<input type="checkbox"/> 015 <input type="checkbox"/> 017 <input type="checkbox"/> 020 <input type="checkbox"/> 022	<input type="checkbox"/> 025 <input type="checkbox"/> 030 <input type="checkbox"/> 035 <input type="checkbox"/> 040		



* Discharge Duct Flange Opening is Same Dimension with 1" Flange All Around



Detail A
400 MBh UNIT VENTING

DIMENSIONAL DATA

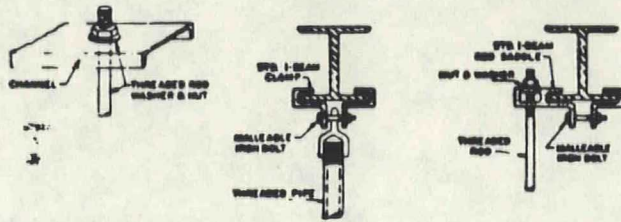
GCNC/GCPC MODELS	INPUT MBh	INCHES									GAS INLET		FAN SIZE DIA X WIDTH
		A	B	C	D	E	F	G	H	S*	NAT	LP	
005	50	31	17 1/4	32 1/4	42 9/16	14 1/4	15 1/4	4 1/4	24 1/4	4" R	1/2	1/2	8" x 8"
007	75	31	17 1/4	32 1/4	42 9/16	14 1/4	15 1/4	4 1/4	24 1/4	5" R	1/2	1/2	8" x 8"
010	100	31	17 1/4	32 1/4	42 9/16	14 1/4	15 1/4	4 1/4	24 1/4	6" R	1/2	1/2	8" x 8"
012	125	31	20 1/4	32 1/4	44 3/16	17 1/2	18 1/4	4 1/4	25 1/4	6" R	1/2	1/2	10" x 10"
015	150	36	20 1/4	37 1/4	44 3/16	17 1/2	18 1/4	5 1/4	17 1/2	7" R	1/2	1/2	10" x 10"
017	175	36	23 1/4	37 1/4	47	20 1/4	20 1/4	5 1/4	19	7" R	1/2	1/2	12" x 12"
020	200	36	26 1/4	37 1/4	47	23	23 1/4	5 1/4	19	8" R	1/2	1/2	12" x 12"
022	225	36	26 1/4	37 1/4	47	25 1/4	26 1/4	5 1/4	19	8" R	1/2	1/2	12" x 12"
025	250	36	31 1/4	37 1/4	47	28 1/4	28 1/4	5 1/4	19	8" R	1/2	1/2	12" x 12"
030	300	36	37 1/4	37 1/4	44 3/16	34	34 1/4	5 1/4	25 1/4	10" ov	1/2	1/2	(2) 10" x 10"
035	350	36	42 1/4	37 1/4	47	39 1/4	40 1/4	5 1/4	26	10" ov	1/2	1/2	(2) 12" x 12"
040	400	36	48 1/4	37 1/4	47	45	45 1/4	5 1/4	26	12" ov	1/2	1/2	(2) 12" x 12"

*R = Round, ov = Oval Refer to Detail A above for 400 MBh unit.

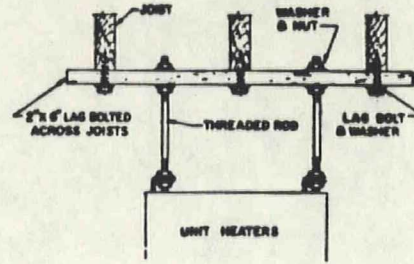
MOUNTING DETAIL

(HANGING HARDWARE SUPPLIED BY OTHERS)

Steel Construction



Wood Construction



PERFORMANCE DATA

MODELS	INPUT-MBh		OUTPUT MBh	AVG. OUTLET VELOCITY AT MAX. CFM FPM	CFM RANGE*	MOTOR HP	APPROX. WT.	
	MAX.	MIN.					NET	SHIP
GCNC/GCPC-005	50.0	25.0	38.5	860	730 - 465	1/8	218	230
-007	75.0	37.5	57.8	945	1000 - 495	1/8	222	234
-010	100.0	50.0	77.0	880	1200 - 925	1/4	235	247
-012	125.0	62.5	96.3	950	1575 - 1160	1/3	250	265
-015	150.0	75.0	115.5	1030	1975 - 1385	1/3	292	309
-017	175.0	87.5	134.8	1045	2300 - 1620	1/2	310	328
-020	200.0	100.0	154.0	965	2400 - 1850	1/2	310	338
-022	225.0	112.5	173.3	935	2600 - 2080	1/2	342	385
-025	250.0	125.0	192.5	930	2850 - 2310	3/4	352	400
-030	300.0	150.0	231.0	1080	3950 - 2780	3/4	390	441
-035	350.0	175.0	269.5	1090	4600 - 3240	1	460	529
-040	400.0	200.0	308.0	1000	4800 - 3700	1	490	562

NOTE:

Ratings are shown for elevations up to 2000 feet above sea level. Above 2000 ft. input must be derated 4% for each 1000 ft. above sea level.

*CFM range is based on 0.2" maximum external static pressure.

MOTOR ELECTRICAL DATA

CURRENT CHARACTERISTICS	FULL LOAD AMPS*					
	1/8 HP	1/4 HP	1/3 HP	1/2 HP	3/4 HP	1 HP
115/60/1	4.4	5.8	7.2	9.8	13.8	16.0
230/60/1	2.2	2.9	3.6	4.9	6.9	8.0
208/60/3	NR	NR	NR	2.2	3.1	4.1
230/60/3	NR	NR	NR	2.0	2.8	3.5
460/60/3	NR	NR	NR	1.0	1.4	1.8

*FLA based on NEC ratings. All motors are 1725 RPM.

NR = motor available, but not rated by NEC.

APPROXIMATE DISTANCE OF THROW (FT) AT NOMINAL AIRFLOW

DISTANCE FROM FLOOR TO BOTTOM OF UNIT	UNIT SIZE INPUT - MBh											
	50	75	100	125	150	175	200	225	250	300	350	400
8'	33	40	56	60	65	70	75	80	85	100	105	112
10'	28	35	49	52	57	61	65	69	74	87	90	97
12'	NR	NR	45	47	51	55	59	63	67	79	83	89
15'	NR	NR	NR	NR	45	49	52	56	60	70	74	80
20'	NR	NR	NR	NR	NR	NR	46	50	54	63	66	70

NR = Not recommended.

MECHANICAL SPECIFICATIONS CENTRIFUGAL FAN GAS UNIT HEATERS

GENERAL

Units are completely factory assembled, piped, wired, and test fired. All units are A.G.A. Certified and conform with the latest ANSI Standards for safe and efficient performance. Units are provided with four point suspension hangers, and are available for operation on either natural or LP (propane) gas.

CASING

Casings are die-formed, 20 gauge galvanized steel and finished in baked enamel. The bottom panel is easily removed to provide service access to the burners, pilot, and orifice. The pilot is also accessible through a side panel access plate. All units provided with independently adjustable horizontal louvers with stops to prevent total closure.

HEAT EXCHANGER

Standard heat exchanger construction consists of seam welded 20 gauge aluminized steel tubes and 18 gauge aluminized steel headers.

DRAFT DIVERTER

Standard draft diverter construction is corrosion resistant aluminized steel.

BURNERS

Burners are die-formed, corrosion resistant aluminized steel, with stainless steel port protectors. Port protectors prevent scale or foreign matter from obstructing the burner ports. Burners individually removable for ease of inspection and servicing. Each burner is provided with an individually adjustable, manually rotated air shutter adjustment.

FANS

Centrifugal fan is belt driven with adjustable pitch motor sheave. Motor and fan are dynamically balanced for quiet operation.

MOTORS

Standard motors are 115 volt, 60 hz, single phase, totally enclosed with built-in thermal overload protection. Optional 230/60/1 motors are available on all units. Optional 208, 230, 460/60/3 motors are available on 125 through 400 MBh units.

CONTROLS

A factory installed junction box is provided for all power connections. Standard units are provided with a 24 volt combination single stage automatic gas valve, including main operating valve and pilot safety shutoff, pressure regulator, manual main and pilot shutoff valve, and adjustable pilot valve. Gas valve is suitable to a maximum inlet pressure of 0.5 psi (14" W.C.) on natural gas. A 24 volt control transformer, high limit, and fan time delay relay are provided. The fan time delay relay delays the fan start until the heat exchanger reaches a pre-determined temperature. It also allows the fan to operate after burner shutdown, removing residual heat from the heat exchanger.

FACTORY INSTALLED OPTIONS

CONTROL OPTIONS

- ☐ Two-Stage Gas Valve

Provides two stages of heat. Ignition is at low fire (50% of the unit's rated input). Requires the use of a two-stage thermostat.

- ☐ Hydraulic Modulating Gas Valve (Natural Gas Units Only)

Provides modulated heat output. Ignition is at low fire (50% input), and discharge temperature sensing bulb located in the air stream modulates the gas input from 100% to 50% rated input. Provided with an automatic electric valve in series which cycles the unit in response to a low voltage single-stage thermostat.

- ☒ Intermittent Pilot Ignition

Solid state ignition control system ignites the pilot by spark during each cycle of operation. When pilot flame is proven, main burner valve opens to allow gas flow to burners. Pilot and burners are extinguished during off cycle.

HEAT EXCHANGER OPTIONS

- ☒ Type 409 Stainless Steel

Heat exchanger tubes and headers are seamed welded 20 gauge type 409 stainless steel.

- ☐ Type 321 Stainless Steel

Heat exchanger tubes and headers are seamed welded 20 gauge type 321 stainless steel.

ADDITIONAL OPTIONS

- ☐ Type 409 Stainless Steel Burners
☐ Orifices for elevations over 2000 feet.
☐ Type 409 Stainless Steel Draft Diverter
☐ Summer/Winter Switch
☐ Vertical Louvers
☒ Duct Discharge Flange

Provided in lieu of louvers on units for use with field ductwork.

- ☐ Totally Enclosed Motor

FIELD INSTALLED ACCESSORIES

☐ Natural to LP (Propane) Gas Conversion Kit

☐ Flue Vent Fan

Flue vent fan provides power venting. Provided with all fixtures for field mounting and wiring, the flue vent fan is activated in response to a single stage thermostat. A centrifugal switch in the flue vent fan in turn activates the automatic electric gas valve.

☐ High Gas Line Pressure Regulator

Reduces main gas line pressure from a maximum of 5 psi to a minimum of 7 inches W.C.

Discharge Nozzles

☐ "Y" Splitter

☒ 45° Downward

☐ 90° Downward

☐ 5-Way Downward

Thermostats

☒ Low voltage room thermostat, single-stage

☐ Low voltage room thermostat, single-stage with summer/winter switch

☐ Low voltage room thermostat, two-stage

☐ Line voltage light duty room thermostat, single-stage

☐ Universal tamper-proof guard for all room thermostats

☐ Low voltage duct thermostat, single-stage

☐ Low voltage duct thermostat, two-stage

TRANE™

09-24-85

The Trane Company
Division of American Standard Inc.La Crosse WI 54601-7588
Clarksville TN 37040

Page Number

Trane Order Number

15

1 CF

1 L S3-L274A

Trane Job Number
S3-NOJOBCustomer Order Number
19165-51137Number of Prints
14Date to Ship
09-24-85Type of Order
SP

Architect

Engineer

Trane Salesman

R.O'BRIEN

Sold To

AXEL NEWMAN P & H
1633 EUSTIS STREET
ST PAUL, MN

55108

Ship To Project

NON-RESPONSIVE

Mark Packages — Project Name

TAG: PO 19165-51137

Item	Quantity	Trane Ordering Number	Specifications
A	2		GCNC007 GCNC007ADA2000H SINGLE STAGE INTERMITTENT PILOT IGNITION 409 STAINLESS STEEL HEAT EXCHANGER DUCT DISCHARGE FLANGE
B	2	0350-0018-14-00	45DEGNOZZLE 45 DEGREE DOWNWARD DISCHARGE NOZZLE
C	2	0350-0015-01-00	24VSTAT PLEASE SEND 6 SETS IOM, PL & WD BCB O'BRIEN TWIN CITIES CSG KW 9-24-85

Submittal Approval Drawings

GCNC-SQ-001.00
GDNC-W-1

Service Literature

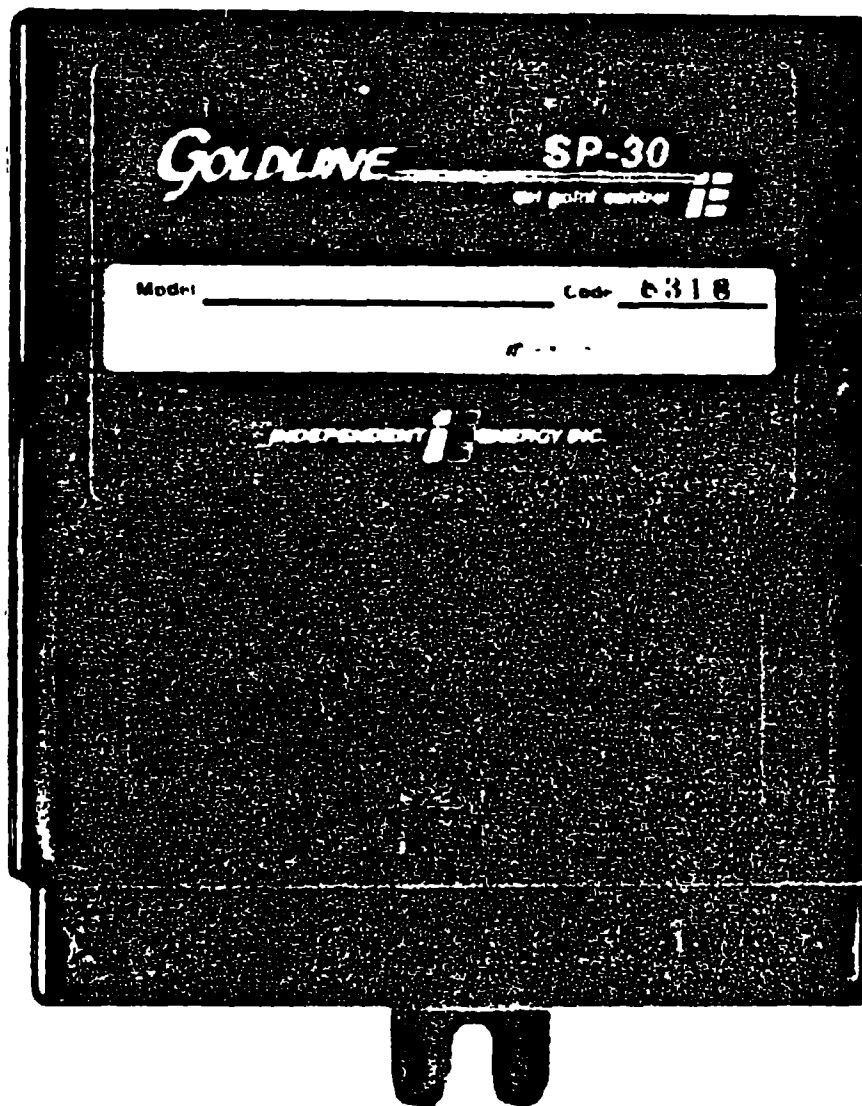
GOLDLINE

SP-30

set point control



OPERATION AND INSTALLATION INSTRUCTIONS



INDEPENDENT  **ENERGY INC.**

P.O. Box 1305, 42 Ladd St., East Greenwich, RI 02818 Tel (401) 884-8990

SP-30 Operation and Installation Instructions

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GENERAL INFORMATION

The Independent Energy Goldline SP-30 is an **ELECTRONIC SETPOINT TEMPERATURE CONTROL**. It utilizes a remotely wired sensor and compares it to an internal setpoint to switch a set of isolated contacts. The SP-30 is engineered to fit virtually any application where control of air or liquid temperature is desired. **EXAMPLES:** boilers, furnaces, ducts, tanks, pipes, solar heating systems, refrigeration, greenhouses, etc.

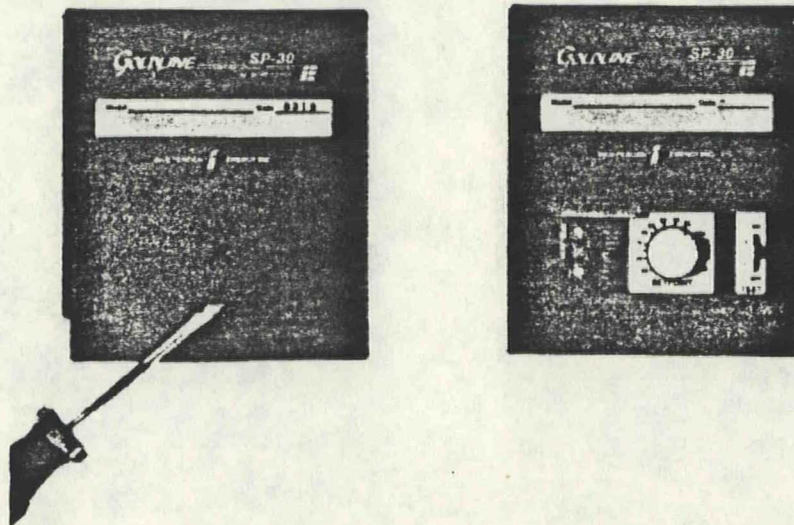
As with the other Goldline solid state controls, the SP-30 is extremely versatile and allows for a single SP-30 model to replace existing lines of electro-mechanical controls

The SP-30 can be directly interfaced - via an Independent Energy Bus Cable - with a Goldline DLX-30 or DM-30 controller. This combination provides for remote, digital temperature and output monitoring, as well as remote temperature setpoint adjustment capability.

SP-30 FEATURES:

- Wide temperature range - adjustable internal setpoint: -26 to 200°F
- Field selectable external setpoint
- Adjustable "turn off" differential - range: 1.5 to 25°F
- "power" and "output" indicators
- Spring return test switch for quick, safe testing of output function
- Digital monitor interface - plug-in adapter for easy, direct interfacing of DLX-30 or DM-30 controls
- Remote sensor location - up to 1,000 ft. from the control via inexpensive bell wire
- Normally open and normally closed contacts- (SPDT, make or break on temperature rise), switches high or low voltage
- Concealed temperature setpoint and differential knobs
- Versatile power requirements: 115 VAC, 230 VAC or 24 VAC
- U.L. listed

CAUTION! The SP-30 is not to be used as a safety control. Its use is to be limited to operational functions only.



OPERATION

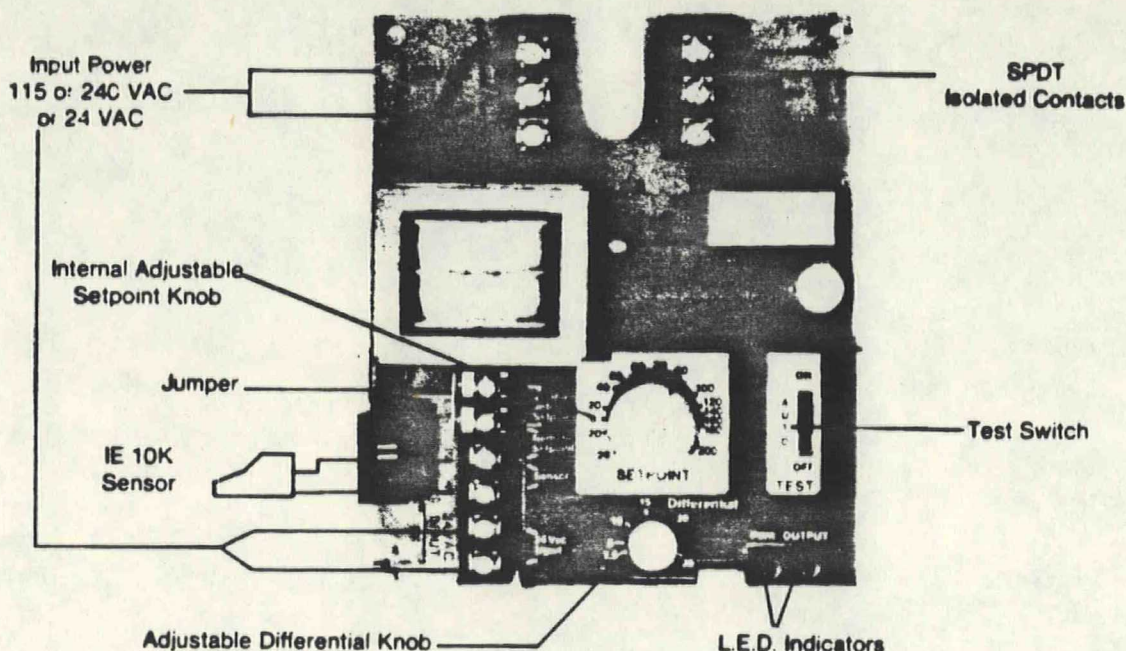


Fig. 1 SP-30

1. Operating Voltage...

The SP-30 can run on 24 VAC, 115 VAC or 230 VAC. The "PWR" L.E.D. indicates that there is power to the control.

2. SP-30 Output...

This output switches the "B-R-W" isolated contacts (SPDT, see SPECIFICATIONS for rating):

- R - B (N.C.) open on a temperature rise
- R - W (N.O.) close on a temperature rise

The output is "on" - as indicated by the L.E.D - whenever the temperature of the sensor wired to terminals 3 and 4 is EQUAL TO OR GREATER THAN THE SETPOINT TEMPERATURE.

3. Temperature Setpoint...

The internal adjustable temperature setpoint range is -26 to 200°F.

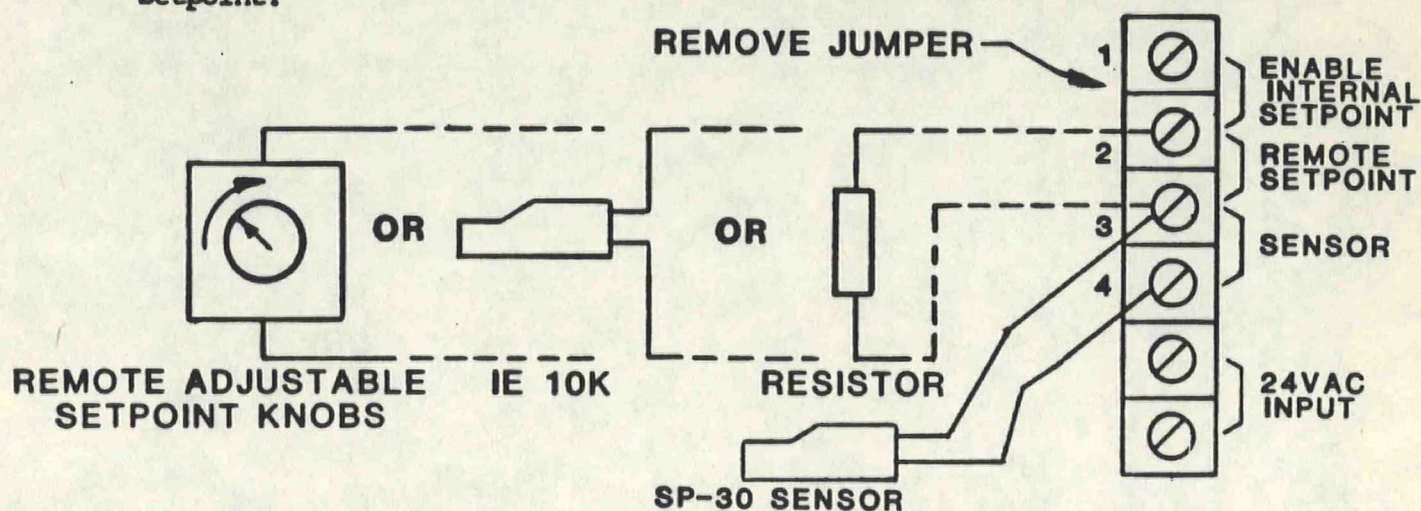
IMPORTANT!

The SP-30 INTERNAL ADJUSTABLE SETPOINT CAN BE DISABLED, such as to use a remote, external setpoint. This external setpoint could be:

1. A remote, adjustable setpoint knob.
2. A resistor (see Temperature vs. Resistance Chart, p.7)
3. An IE 10 k sensor
4. The T1 Adjust Knob on a DLX-30 which is interfaced with the SP-30

OPERATION, cont'd.

To disable the internal adjustable setpoint, remove the jumper which is factory installed across terminals 1 and 2. Then, to utilize an external setpoint:



OR, to use the DLX-30 T1 Adjust Knob as the external setpoint, see OPERATION 6.

Fig. 2

4. "Turn off" Differential...

The temperature setpoint output turns "off" whenever the SP-30 sensor temperature drops to the setpoint temperature, LESS THE DIFFERENTIAL SETTING. The turn "off" differential is adjustable, range: 1.5 to 25°F.

To access this knob, disconnect power to the control and remove entire cover (see Fig. 1).

5. Test Switch (spring loaded)...

This switch spring returns to the "auto" position for normal control function. The "on" and "off" positions should be used when servicing or trouble shooting the system.

6. DLX-30(or DM-30)/SP-30 Systems...

The SP-30 control can be interfaced directly with a Goldline DLX-30 or DM-30 control via an IE Bus Cable:

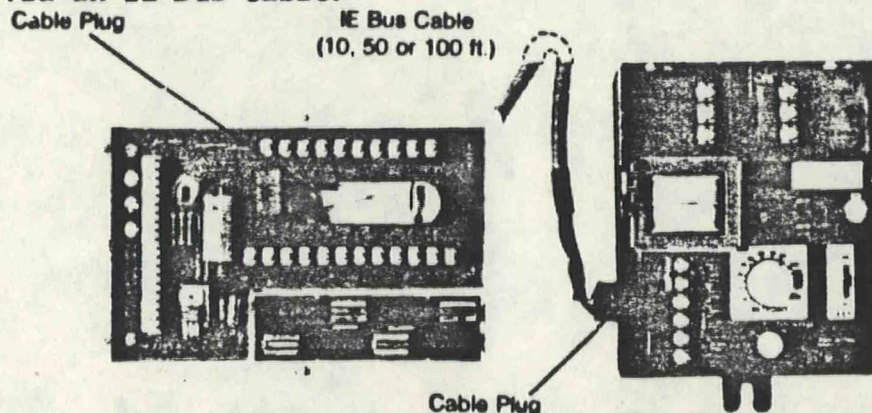


Fig. 3 DLX-30(or DM-30)/SP-30 Interfacing

This combination provides for remote, digital temperature and output monitoring in the following fashion:

TO READ...

- SP-30 temperature setpoint
- SP-30 sensor

PRESS DLX-30 or DM-30 KEY...

- T1 (range: -27 to 227 $\pm 2^{\circ}\text{F}$)
- T2 (range: -27 to 227 $\pm 2^{\circ}\text{F}$)

The SP-30 output "on" status is indicated by the **1** indicator on the DLX-30 or DM-30 display.

In addition, the T1 Adjust Knob on the DLX-30, only, can be used to remotely set the SP-30 temperature setpoint. To do this, the SP-30 internal setpoint must be disabled (see OPERATION 3 of this manual) and the DLX-30 must be set up accordingly (see the DLX-30 manual).

Furthermore, on the DLX-30, only, the EVENT key displays the total number of "off"-to-"on" transitions of the SP-30 output and the RUN TIME key displays the accumulated "on" time of the SP-30 output. See the DLX-30 manual for further details.

INSTALLATION

Installation must be performed by trained service personnel, and in accordance with N.E.C. and local codes.

CAUTION! Disconnect all power during installation.

MOUNTING:

Ensure adequate clearance on left side of control for IE Bus Cable and/or sensor wiring connections to the SP-30. The control is mounted to a surface via two screws (provided).

WIRING:

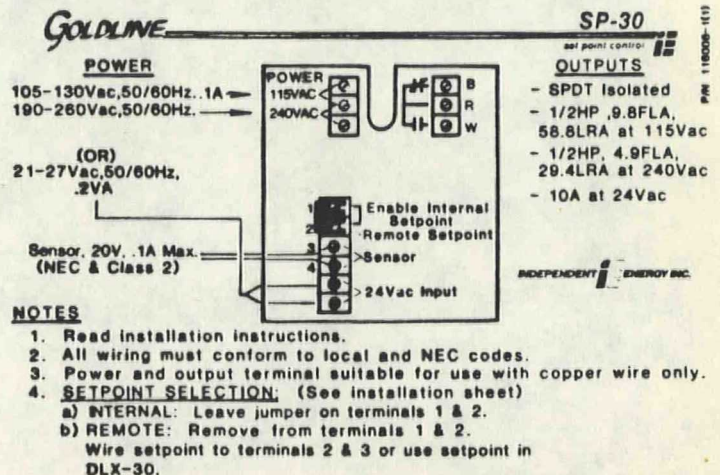
NOTE: SP-30 terminal strips have special wire clamps that allow good electrical connection to plain, stripped wire ends. No wire lugs are required.

1. Input power wiring:

115 VAC, 230 VAC or 24 VAC. Refer to wiring label on inside cover.

2. Output wiring (W-R-B):

Isolated contacts, SPDT. Refer to wiring label on inside cover.



3. Sensor mounting and wiring:

- Mechanically mount the sensors (e.g. bolt, hose clamp, etc.) - DO NOT tape or solder. The use of thermally conductive grease applied between sensor and mounting surface will enhance the accuracy of the sensor.
- Always insulate the sensor to minimize the effects due to ambient temperature. Sensors located outdoors must be protected from rain and snow.
- Sensor wire should be at least 18 AWG. Sensor wires that are exposed to weather should be suitable for the purpose (neoprene jacket).
- Shielded wire (e.g. Belden #8760 for indoor use, Belden #8428 for outdoor use) is recommended for sensor wiring runs that travel near other electrical equipment, near A.C. wiring, ham/CB radio transmitters or other sources of electrical interference. Ground the shields to one of the cover screws. DO NOT ground the shields at the sensor end of the sensor wiring.

4. Wiring an external temperature setpoint:

This applies only where the internal temperature setpoint is not to be used. See OPERATION 3.

CHECKOUT PROCEDURE:

- Before applying power, check all input and output wiring for proper termination.
- Turn on AC power at circuit breaker panel. Verify that "PWR" indicator is on (see Fig. 1).
- Move test switch to "off" position. "Output" indicator should be off and R-W output contacts should be made.
- Move test switch to "on" position. "Output" indicator should be on and R-B contacts should be made.
- Return test switch to "auto" position for normal operation.

SPECIFICATIONS

Power requirements: 24 VAC $\pm 10\%$, 2VA; or 105-130 VAC, 50/60 Hz; or 190-270 VAC, 50/60 Hz

Output rating: SPDT isolated contacts, 1/2 HP, 9.8 FLA, 58.8 LRA @ 115 VAC;
1/2 HP, 4.9 FLA, 29.4 LRA @ 230 VAC; 10A @ 24 VAC

Operating ambient temperature range: 32 to 122°F

Temperature sensors: IE 10 K thermistors @ 77°F

Temperature accuracy: $\pm 1^\circ\text{F}$ (using DLX-30 or DM-30 digital monitor)

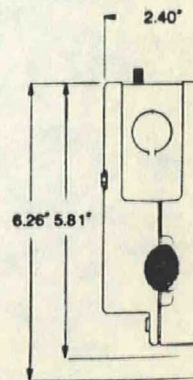
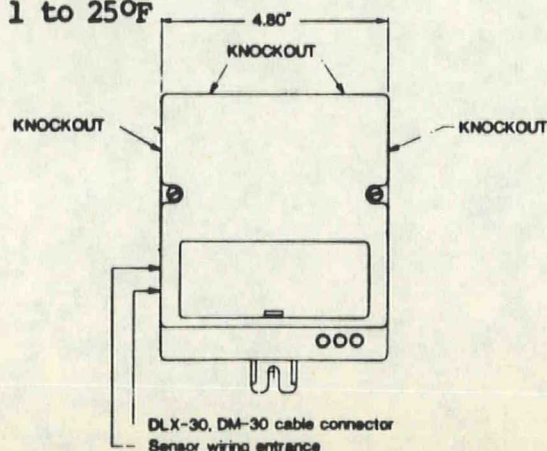
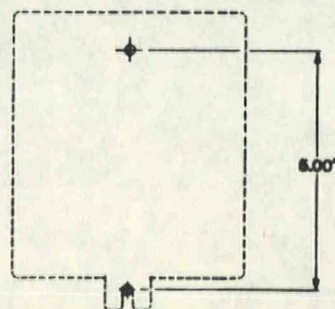
Internal temperature setpoint range: -26 to 200°F

Temperature setpoint differential range: 1 to 25°F

Dimensions: 5 5/8" x 4 7/8" x 2 3/8"

Weight: 2 lbs.

ESD protected
RFI/EMI protected
UL listed



TROUBLE SHOOTING

NOTE: If any of the items below fail to resolve your particular control problem, call your dealer, Rep or the factory for further assistance and/or instructions for returning the control - 800-343-0826.

PROBLEM	POSSIBLE CAUSE	TEST/CHECK
"power" indicator is not on	No a.c. power to SP-30	Check to see that circuit breaker is on
		Check for proper a.c. connections and voltage at SP-30 input terminals
"output" indicator does not come on	Test switch is in "off" position	Return test switch to "auto" position
	SP-30 sensor temperature not equal to or greater than setpoint temperature	Check sensor resistance (see chart p.7) vs setpoint temperature
	Open in SP-30 sensor wiring	Check for continuity w/ohm meter
	Defective SP-30 sensor	Cross check sensor resistance w/actual temperature
"output" indicator does not go off	Test switch is in "on" position	Return test switch to "auto" position
	SP-30 sensor temperature not less than setpoint temperature, minus the differential setting	Check sensor resistance (see chart p.7) vs setpoint temperature and differential setting
	Short in SP-30 sensor wiring	Check for continuity w/ohm meter
	Defective SP-30 sensor	Cross check sensor resistance w/actual temperature
"output" indicator on (or off) but load (boiler, pump etc.) not operating (or operating)	Load wired incorrectly to output contacts (i.e. N.C. vs. N.O.)	Check for proper wiring of load to output contacts

NOTE: Remove sensor wires from terminal strip when checking resistance.

Temperature vs. Resistance (°F vs. ohms)
10,000 ohm thermistor @ 77°F

°F	OHMS	°F	OHMS	°F	OHMS	°F	OHMS	°F	OHMS
-30	234314	23	42333	75	10502	127	3244	179	1191
-29	226140	24	41113	76	10248	128	3177	180	1170
-28	218281	25	39933	77	10000	129	3112	181	1150
-27	210723	26	38791	78	9760	130	3048	182	1129
-26	203454	27	37685	79	9526	131	2986	183	1110
-25	196462	28	36614	80	9299	132	2925	184	1090
-24	189735	29	35577	81	9078	133	2866	185	1071
-23	183263	30	34574	82	8862	134	2808	186	1053
-22	177035	31	33602	83	8653	135	2752	187	1035
-21	171041	32	32660	84	8449	136	2697	188	1017
-20	165271	33	31748	85	8250	137	2643	189	999
-19	159716	34	30864	86	8057	138	2590	190	982
-18	154368	35	30008	87	7869	139	2538	191	965
-17	149218	36	29179	88	7685	140	2488	192	949
-16	144258	37	28375	89	7507	141	2439	193	933
-15	139481	38	27597	90	7333	142	2391	194	917
-14	134878	39	26841	91	7165	143	2344	195	901
-13	130444	40	26109	92	7000	144	2298	196	886
-12	126172	41	25400	93	6839	145	2253	197	871
-11	122054	42	24712	94	6683	146	2209	198	857
-10	118085	43	24045	95	6531	147	2166	199	842
-9	114260	44	23399	96	6383	148	2124	200	828
-8	110571	45	22771	97	6238	149	2083	201	814
-7	107015	46	22163	98	6098	150	2043	202	801
-6	103586	47	21573	99	5961	151	2004	203	788
-5	100278	48	21000	100	5827	152	1966	204	775
-4	97088	49	20445	101	5697	153	1928	205	762
-3	94010	50	19906	102	5570	154	1891	206	749
-2	91041	51	19383	103	5446	155	1856	207	737
-1	88176	52	18876	104	5326	156	1820	208	725
0	85410	53	18383	105	5208	157	1786	209	713
1	82742	54	17905	106	5094	158	1753	210	702
2	80166	55	17440	107	4982	159	1720	211	690
3	77679	56	16990	108	4873	160	1688	212	679
4	75277	57	16553	109	4767	161	1656	213	668
5	72959	58	16128	110	4663	162	1625	214	658
6	70719	59	15715	111	4562	163	1595	215	647
7	68557	60	15314	112	4464	164	1566	216	637
8	66467	61	14925	113	4368	165	1537	217	627
9	64449	62	14548	114	4274	166	1509	218	617
10	62499	63	14180	115	4183	167	1481	219	607
11	60614	64	13823	116	4094	168	1454	220	597
12	58793	65	13477	117	4006	169	1427	221	588
13	57033	66	13140	118	3922	170	1402	222	579
14	55332	67	12812	119	3839	171	1376	223	570
15	53687	68	12494	120	3758	172	1351	224	561
16	52096	69	12185	121	3679	173	1327	225	552
17	50558	70	11884	122	3602	174	1303	226	543
18	49071	71	11592	123	3527	175	1280	227	535
19	47633	72	11308	124	3453	176	1257	228	527
20	46241	73	11032	125	3382	177	1235	229	519
21	44895	74	10763	126	3312	178	1213	230	510
22	43593								

WARRANTY INFORMATION

ONE YEAR LIMITED WARRANTY AND CONTINUING FOUR YEAR LIMITED WARRANTY

Independent Energy, Inc. warrants its products to be free from defects in material or workmanship and will perform, as specified in writing by Independent Energy, Inc. under normal use and service for one year from date of installation, provided that said products have been installed in accordance with seller's installation instructions.

Please fill out and return the warranty registration card upon completion of installation of the control.

If product fails in service and failure constitutes a breach of above warranty, return the product as per instructions below. Seller will repair or replace the product (with same or functional equivalent), at seller's option, free of charge and return it transportation prepaid.

The complete Independent Energy, Inc. limited warranty statement is available upon request.

EXTENDED WARRANTY

Independent Energy, Inc. offers extended coverage should a defect be identified after the Limited Warranty has expired. Independent Energy, Inc. will repair or replace the defective product with same or functional equivalent (at seller's option) for a period not exceeding five years from date of installation, for a service charge.

RETURN INSTRUCTIONS

To obtain an RGA # (Return Goods Authorization #) and/or the current extended warranty service charges, call Independent Energy's Customer Service Department shown below.

The product should be returned prepaid to Independent Energy, Inc., accompanied by a certified bank check, money order or personal check. Do not send cash. In addition, a description of the problem observed, a clearly written return address and the product's serial number (if present) should be included. Proof of installation or purchase date must accompany product being returned under this warranty if the warranty registration card was not mailed in at the time of installation.

If you need an RGA #, additional information or would like to comment on our products or services, write to us or call us at:

Independent Energy, Inc.
Customer Service Department
42 Ladd Street
P O Box 1305
East Greenwich, Rhode Island 02818

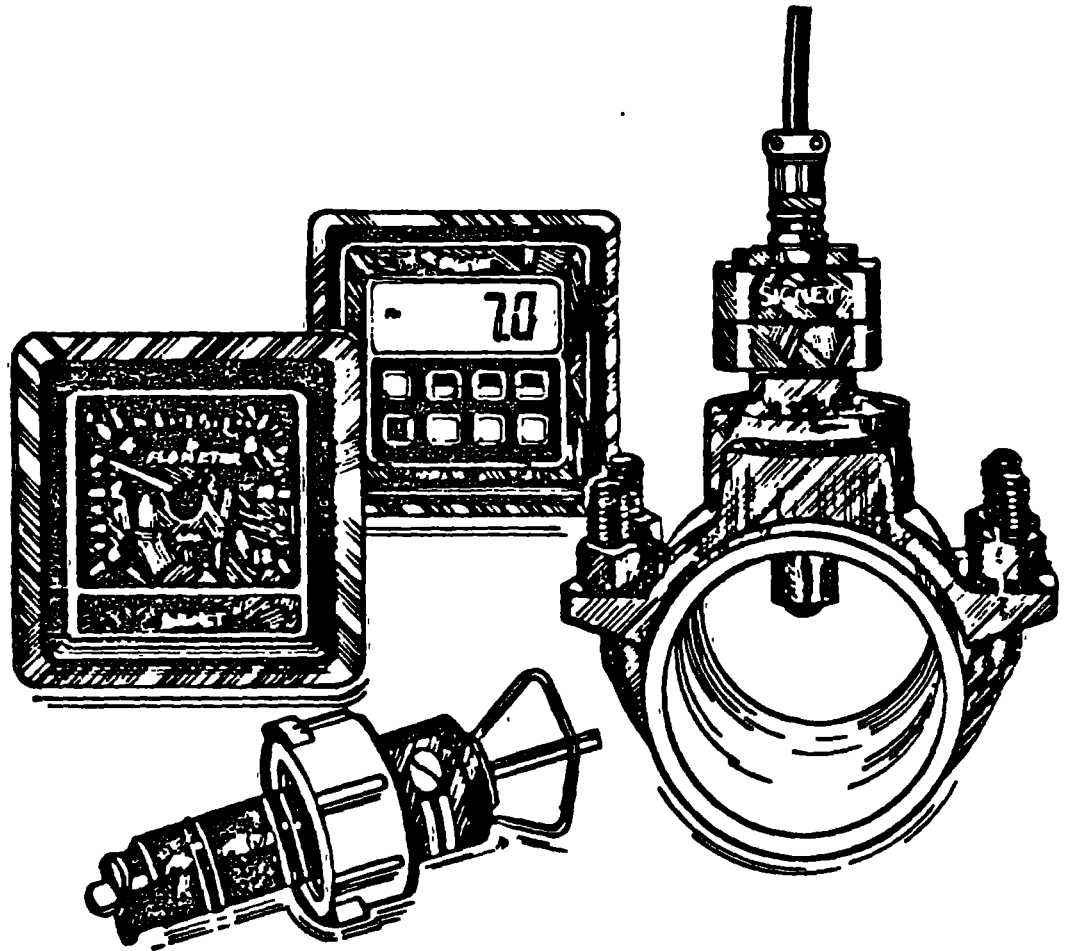
800-343-0826



 **SIGNET SCIENTIFIC**

**MK 575/575R
ACCUM-U-FLO**

**INSTRUCTION
MANUAL**



**MK 575/575R
ACCUM-U-FLO**

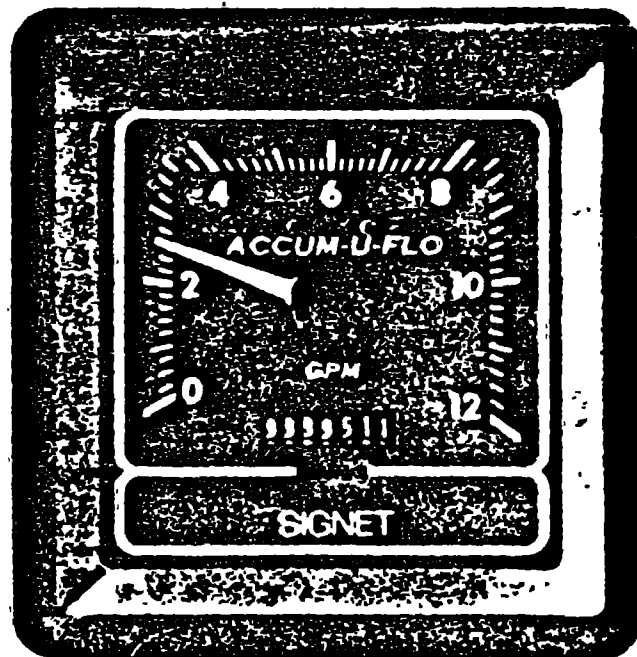


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1. INTRODUCTION

This manual contains description, specifications, and instructions for the installation and operation of your Signet MK 575/575R Accum-u-flow indicators. PLEASE READ ALL OF THIS INSTRUCTION MANUAL; it will answer most of your questions about installation and calibration of this indicator.

The MK 575 indicates flow rate and total flow of a liquid in a pipe by measuring the signal generated by a Signet Flosensor. This measurement is displayed on a large, graduated analog meter. An accumulator counter totalizes the volume of flow.

The MK 575 is compatible with all Signet Flosensor transducers. Using a compatible Flosensor, and other Signet instruments, systems can be assembled to measure, control, and/or integrate flow over a wide range of parameters.

The MK 575 contains a high-torque meter movement to ensure proper operation in high-vibration environments. The MK 575 requires no routine maintenance.

The MK 575 requires 12-volt dc at 315 milliamps. A 12-volt dc converter is included which allows you to power the indicator from 117 volts ac nominal.

accumulated volume on a 7-digit non-resettable counter. The MK 575R performs this measurement on a 5-digit resettable counter. Reset the counter by pushing in the reset button on the front panel immediately below the counter display.

Volume and rate measurements are usually indicated in gallons or liters per minute, but the indicator and counter can be calibrated to measure virtually any volumetric unit from milliliters to acre-feet.

The analog meter of the MK 575 deflects 245 degrees full-scale with large numbers on a 5-1/2 inch dial for easier reading at a distance. The meter movement has $\pm 1/2\%$ of full scale repeatability and is internally damped to reduce pulsation caused by flow fluctuations.

The MK 575 can be mounted in an instrument panel or on the optional mounting bracket (see 6.2 Optional Accessories). The Flosensor output connects to the terminal strip on the rear of the MK 575 case. The meter face is waterproof. However, if the unit is to be installed in a wet or dusty environment, it should be housed in a Signet MK 500 75 NEMA-rated enclosure. The MK 500 78 Conduit Mounting Kit (see 6.2 Optional Accessories) is a waterproof enclosure on the rear of the MK 575. It provides conduit adapters to permit housing all cabling in conduit.

1.1 DESCRIPTION

The MK 575 uses digital electronics to measure both total volume and rate of flow in a system. The indicator is offered in two versions to measure total volume. The MK 575 measures ac-

<p>NOTE THE STATEMENTS REFERRING TO THE MK 575 ALSO INCLUDE THE MK 575R</p>

1.2 SPECIFICATIONS

Input Signal Amplitude	0.4 volt peak-to-peak minimum
Input Frequency Range	5 to 200 Hz (5 to 500 Hz when used with MK 505)
Input Impedance	47 kilohms (10 kilohms when used with MK 505)
Rate Display Accuracy	$\pm 1\%$ of full scale
Rate Display Repeatability	$\pm 1/2\%$ of full scale
Volume Display Accuracy	$\pm 2\%$ of reading at calibrated flow rate, \pm quantizing error (usually negligible)
Outputs	
Pulse TTL Compatible	source, 6.5 milliamps at 4.6 V sink 25 milliamps at 0.4 V
Frequency	synchronous with input
Pulsewidth	5 milliseconds nominal

(continued)

Counter TTL Compatible	source, 5 milliamps
	sink, 5 milliamps
Frequency	synchronous with accumulator
Pulsewidth	100 milliseconds \pm 20%
Power Requirements	12 Vdc, 315 milliamps Not damaged by voltage as high as 25 Vdc
	Contains reverse voltage protection.
Ambient Operating Temperature	0°C to 60°C (32°F to 140°F)
Weight	1.8 lbs (0.82 kilograms)
Power Supply Converter	
Input	117 Vac nominal at 0.19 amp max
Output	12 Vdc at 1.2 amps

2.0 INSTALLATION

2.1 UNPACKING AND INSPECTION

When unpacking your MK 575 package, be sure you have received everything (see Figure 1). Carefully check each item for any damage incurred during shipment. If damage has occurred, promptly notify your dealer and the shipping carrier.

The following items are included in your MK 575 package:

- 1 MK 575 Accum-u-flo indicator
- 2 M15129 Mounting Strap
- 3 P30075 Power Converter
- 4 Instruction Manual and Warranty Card

Please fill out and return the Warranty Card as soon as possible.

2.2 INDICATOR INSTALLATION

The MK 575 may be installed as far as 200 feet from the Fiosensor. If the indicator location is beyond the standard 25-foot sensor cable length, an extension cable must be used. Additional distances, or systems incorporating several instruments, may require the use of a Signet MK 514 Signal Conditioner. The MK 575 may be used in combination with all Signet indicating and controlling instruments.

The MK 575 may be mounted in an instrument panel having a 5.1 inch square hole with sufficient clearance around it to accommodate the 5-1/2 inch front bezel of the indicator. There must be a minimum 4-3/4 inch rear clearance.

Installation

- 1 Loosen the clamp ring (see two "A" screws in Figure 2)

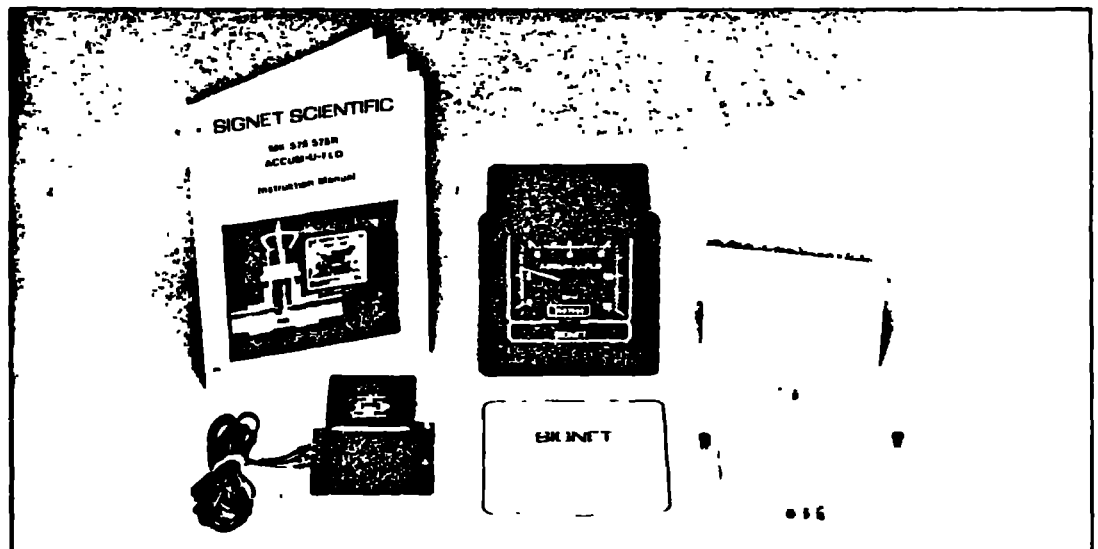


Figure 1.

2. Insert the rear of the indicator through the front of the prepared hole.
3. Slip the clamp ring over the rear of the indicator. With the front flange of the indicator held tightly against the front of the panel, position the clamp ring snugly against the rear of the panel.
4. Tighten the two "A" screws.
5. Seal the front flange firmly against the panel by tightening the two "B" clamping screws hand tight (see Figure 2). Do not overtighten these screws. Overtightening will cause the clamp ring to slip.
6. Remove the plastic safety shield from the rear terminal strip by pinching inward each pair of plastic locking latches. Then connect the Flosensor output cable to the appropriate XDCR (transducer) terminals on the rear of the indicator case (see Figures 3 and 4).
7. Connect a 12 Vdc source or the Signet Power Converter to the Vdc + and - terminals on the rear panel of the MK 575. When using the supplied Signet Power Converter, connect 117 Vac nominal to the input terminals of the converter. Then connect either adjacent + and - output terminal pair of the converter to the 12 Vdc + and - terminals respectively, on the rear panel of the MK 575. The extra pair of 12 Vdc output terminals on the converter is available to power another Signet indicator requiring the same dc source as the MK 575. Make any other desired connections on the terminal strip, such as PULSE OUT and/or CNT. (counter) OUT* with circuit-low connected to SIG GND (signal ground). Replace the plastic safety shield on the terminal strip.

NOTE
FOR FLOSENSOR INSTALLATION REFER TO APPROPRIATE SIGNET INSTRUCTION MANUAL

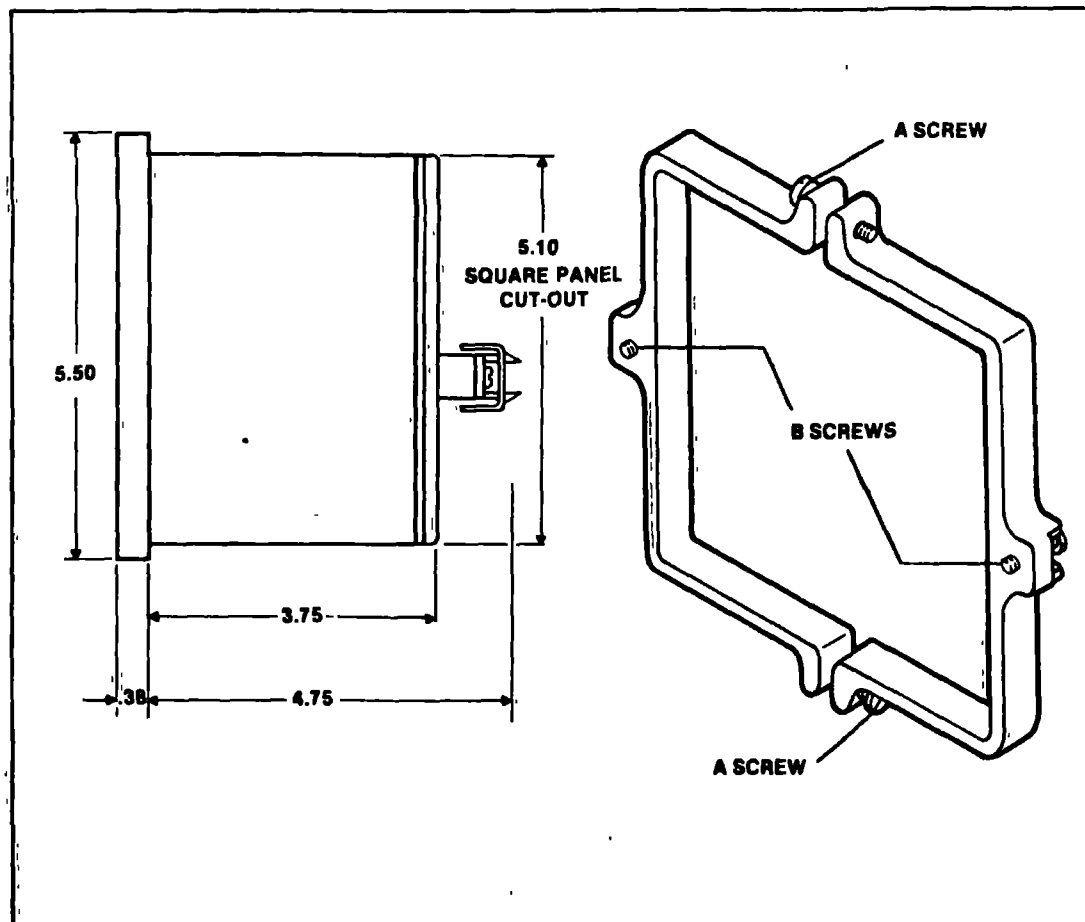


Figure 2. Detailed profile of the MK 575 (left) and isometric view of clamp ring (right).

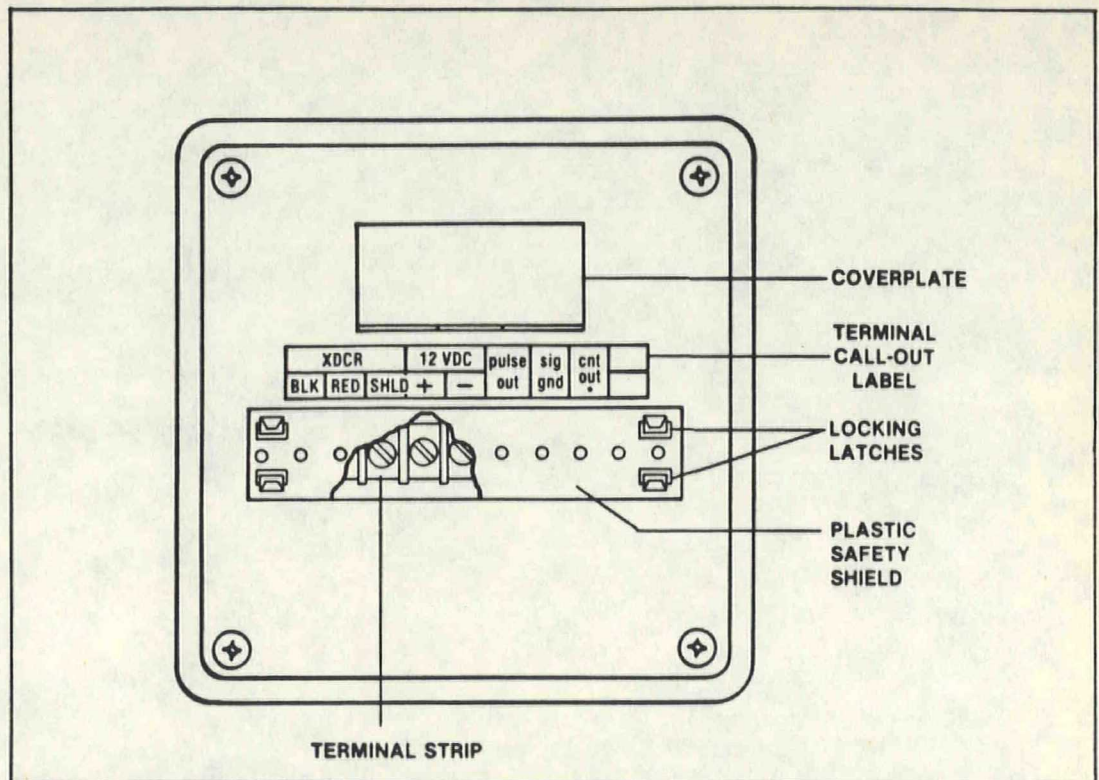


Figure 3. Rear view of MK 575 with coverplate in place over calibration and counter controls.

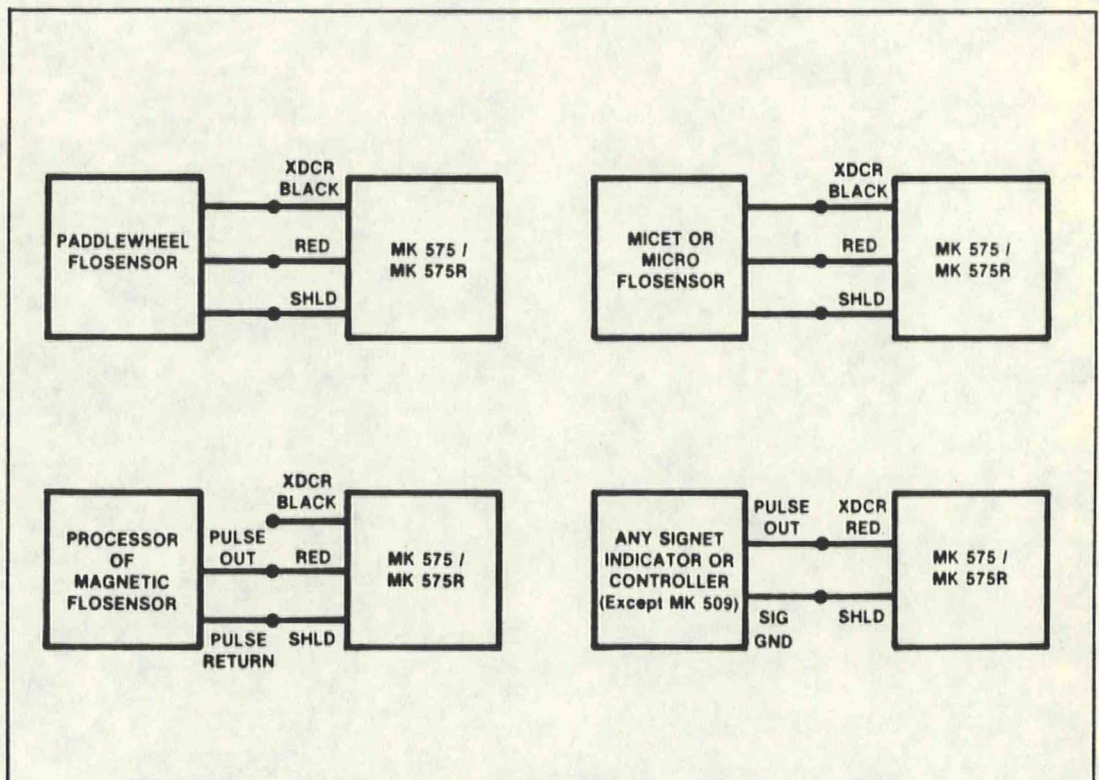


Figure 4. Various inputs to MK 575/575R Accum-u-flo. Verify all flosensor output connections by referring to the appropriate Signet instruction manual.

3.0 THEORY OF OPERATION

Basically, the MK 575 Accum-u-flo electronics convert the sinusoidal ac transducer signal from a Signet Flosensor into fixed-width positive pulses. The time between leading edges of two adjacent pulses is equal to one cycle of transducer output frequency. These pulses are converted into an analog voltage which drives the meter.

The single printed circuit (PC) board of the MK 575 contains the voltage regulator, the input-shaping and processing circuitry, the meter-drive circuitry, and the counter-drive circuitry. The +12 Vdc power for the electronics is applied to the PC board voltage input. A diode is in series with the +12 volt line to provide reverse-voltage protection. The unregulated +12 Vdc is applied to a voltage regulator to provide a regulated +5 Vdc to power the MK 575.

The input module of the MK 575 conditions the Flosensor signal. The processor circuitry then forms the conditioned input signal into square-wave-shaped, precision width, noise-free positive pulses. The pulses are also separately amplified and are available to drive external instrumentation, including other Signet indicators and controllers, at the PULSE OUT terminal on the MK 575's rear panel (see Figure 3). Internally, these pulses are input to a frequency-to-current converter. This circuitry employs a constant-current generator where the pulse waveforms are converted to a current in a closed-loop system by charging a capacitor, with this charge being directly proportional to the frequency. This current drives the Flometer's meter.

TABLE 1

	PADDLEWHEEL	MICET/MICROFLO	MAGNETIC
Transducer	MK 515 or MK 415	MK 505 or MK 508	MK 566
Module P/N	M0177	P30507	M0177
#1	SIG REF	+ 5V	N/A
#2	SIG HIGH	SIG	SIG HIGH
#3	GND	GND	GND
#4	+ 12V	+ 12V	+ 12V
#5	12V RETURN = POWER GROUND	12V RETURN = POWER GROUND	12V RETURN = POWER GROUND
#6	PULSE OUT	PULSE OUT	PULSE OUT
#7	SIG GND	SIG GND	SIG GND
#8	COUNTER OUT	COUNTER OUT	COUNTER OUT
#9	N/A	N/A	N/A

Reference the simplified block diagram of the indicator circuitry as shown in Figure 5. The Flosensor transducer output signal is applied to the input module of the MK 575. This interchangeable module is available in two configurations which allow the MK 575 to process signals from the various types of Signet Flosensors (Paddlewheel, Magnetic, Microflo, or Micet). The configuration required for your Flosensor is factory installed. Table 1 lists the sensor type with the required input module, and resulting assignments on the terminal strip.

The pulse signal is connected to a presettable divide-by N counter circuit. The counter divides the pulse frequency by a preset number. This number, N, is the number dialed into the rear-panel rotary decade switches, plus one (see Figure 6). For example, if 378 is dialed into the switches, the counter will divide by 379. The divider has a division range of 2 to 10000, corresponding to switch settings from 0001 to 9999. The counter also provides an output to drive an external counter, pump, or other equipment at the CNT OUT* terminal on the rear of the MK 575 (see Figure 3).

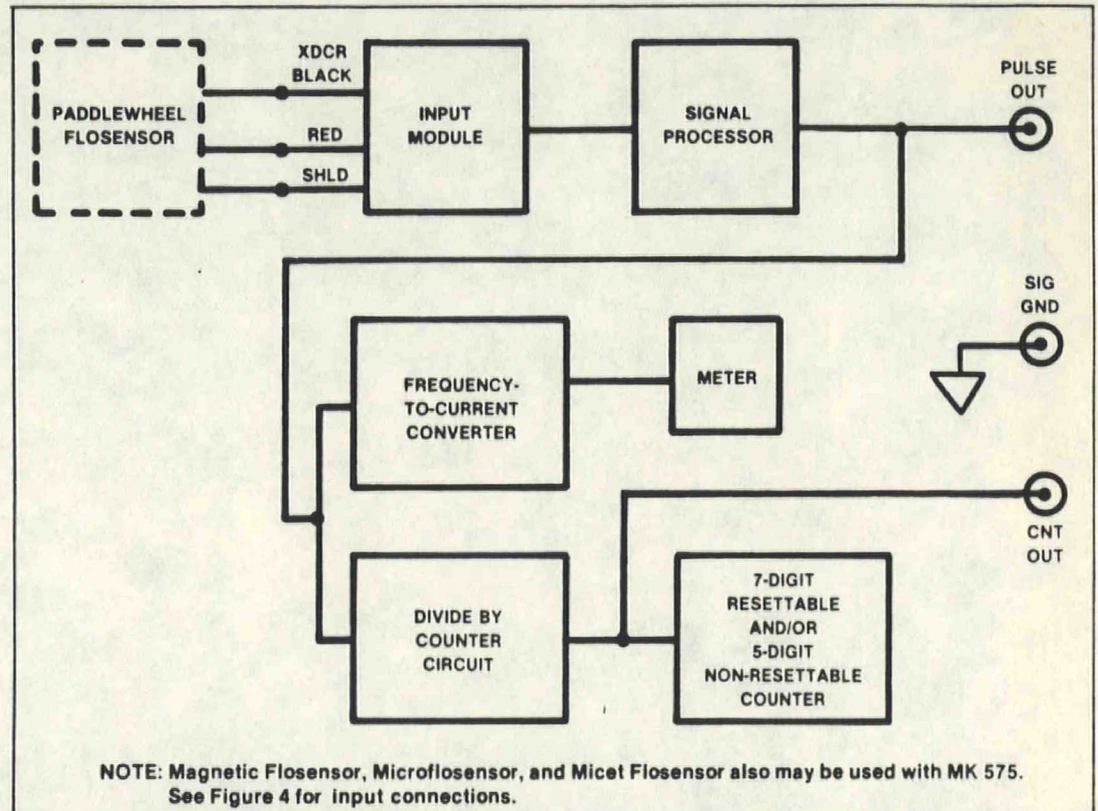


Figure 5. Block diagram of MK 575/575R circuitry.

4.0 CALIBRATION

Your MK 575 Accum-u-flo indicator was factory calibrated to a water standard for your particular pipe fitting and Signet Flosensor type (indicated on the rear of the MK 575 case). If used with this pipe fitting, recalibration should not be necessary unless the viscosity of the fluid used differs substantially from water. This indicator must be used with the Signet Flosensor transducer type specified. Use of another transducer type may require a different input module or recalibration.

The flow measurement and accumulator sections of the MK 575 are independent of one another. Each section is calibrated separately.

4.1 FLOMETER CALIBRATION

Adjusting the MK 575 meter movement for different units of measurement or recalibration can be accomplished using the Signet MK 561 Flow Test Indicator (see 6.2 Optional Accessories). The complete procedure for using this Tester is supplied in its manual.

NOTE:

FOR COMPLETE CALIBRATION DATA AND PROCEDURES, REFER TO SIGNET'S CALIBRATION MANUAL. CONSULT THE FACTORY FOR DETAILS.

4.2 COUNTER RECALIBRATION

Recalibrating the counter circuitry can be accomplished in the field simply by resetting the decade rotary switches on the rear of the MK 575 case (see Figure 6) using the appropriate K factor (pulses/gallon or pulses/liter) from Table 2 in the following equation:

$$(K \times I) - 1 = \text{Setting of Switches}$$

where I is the number of increments you want counted.

For example, if you want the counter to count in 10-liter increments, and your pipe size is 2-1/2"-80, the K pulses/liter value is 6.123. Therefore,

$$(6.123 \times 10) - 1 = 60.23$$

Rounding off the answer to the nearest integer gives 60. Thus switches would be set to 0060.

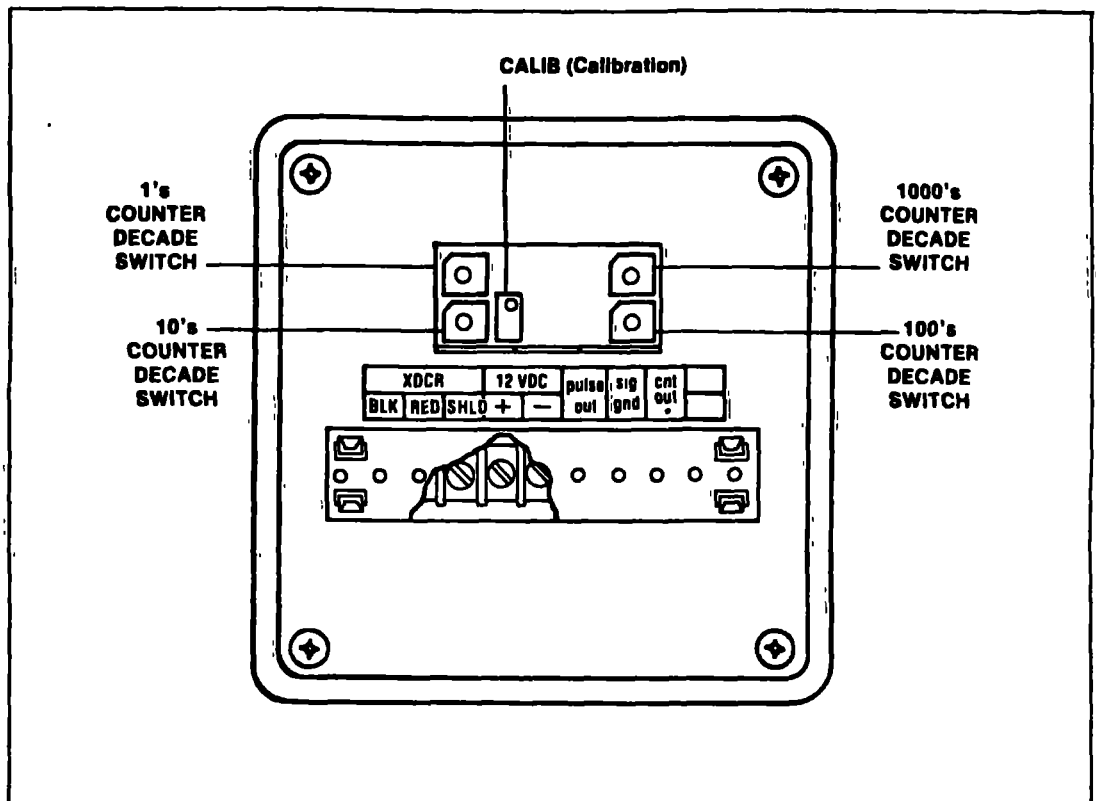


Figure 6. Rear view of MK 575/575R with calibration and counter controls exposed.

NOTE

THE VALUES SHOWN IN TABLE 2 ARE DERIVED FROM SIGNET'S CALIBRATION CHART. THEY ARE NOT IDENTICAL TO THE CHART VALUES AND ARE NOT MEANT TO REPLACE THE CALIBRATION CHART.

If, because of some peculiarities in your piping system or the material flowing in that system, the MK 575 does not read correctly, you may have to adjust the calibration by some small percentage. This can be done using the following equation:

$$\frac{\text{Indicated Flow Volume}}{\text{Actual Flow Volume}}$$

$$X (\text{Setting of Switches} + 1) - 1 = \text{New Setting of Switches}$$

For example, with an actual flow of 100 gallons, the indicator shows 110 gallons. The switches are set at 271. Therefore,

$$\frac{110}{100} \times (271 + 1) - 1 = 298.2$$

Rounding off the answer to the nearest integer gives 298. Thus switches would be set to 298.

NOTE

FOR COMPLETE CALIBRATION DATA AND PROCEDURES REFER TO SIGNET'S CALIBRATION MANUAL.

Table 2

NOMINAL DIAMETER	PIPE SIZE/ SCHEDULE	ACTUAL I.D.	K* PULSES/ GALLONS	K* PULSES/ LITERS
½"	80	0.526"	451.2	119.2
¾"	80	0.722"	254.9	67.34
1"	80	0.935"	183.5	48.49
1-¼"	80	1.256"	88.27	23.32
1-½"	80	1.476"	59.93	15.83
2"	80	1.913"	33.53	8.861
2-½"	80	2.291"	23.17	6.123
3"	80	2.864"	14.62	3.865
4"	80	3.789"	8.171	2.159

* Illustrative values only

5.0 MAINTENANCE AND TROUBLESHOOTING

Your MK 575 was designed to require no routine maintenance. After correct installation has been verified, malfunctions will generally be traceable to operating conditions at the flosensor transducer (for example, sediment or particulate matter clogging the free movement of the rotor of a Paddlewheel Flosensor), not within the transducer or indicator. Transducer-oriented problems are explained in detail in the appropriate Signet Flosensor instruction manual. Please refer to it.

Non-transducer problems may be traced to the power supply. Measure the dc voltage from the power source to be sure it is within specifications (see 1.2 Specifications).

Malfunctions isolated to the Flosensor or MK 575 can be checked only by qualified technicians working in a well-instrumented technical laboratory. Attempting repairs inside the Flosensor or MK 575 can void your limited warranty (see 6.3 Warranty).

Meter	M00108
Mounting Strap Kit	M15129
Reset Button Kit (MK 575R)	MK 75 95
Power Converter	P30075

6.2 OPTIONAL ACCESSORIES

Mounting Bracket	MK 500 60
Conduit Mounting Kit	MK 500 78
Liquid Tight Kit one ½" NPT Hub and two ¾" NPT hubs for waterproof cable con- nections to 500 Series Flometers with rear en- closures	MK 500 75
Flow Test Indicator	MK 561
Cable Adapter Kit Flosensor-to- Tester and Tester-to- Flometer adapter cables for the MK 561	MK 561 60
Cable Adapter Kit Series 300 Sensor to MK 575, adapter cables	MK 500 61-1

6.0 APPENDICES

6.1 PARTS LIST

Case (MK 575)	MK 509 49
Case (MK 575R)	MK 575 49
Glass (MK 575)	MK 509 47
Glass (MK 575R)	MK 575 47

6.3 WARRANTY

SIGNET SCIENTIFIC COMPANY LIMITED TWO-YEAR WARRANTY

Signet Scientific Company warrants its instruments to be free from defects in material and workmanship under normal use for a period of two years from date of purchase by the initial

owner, or three years from date of manufacture, whichever comes first, as described in the following paragraphs.

This warranty does not cover defects caused by abuse or electrical damage. Signet will not cover under warranty any instruments damaged during shipment to the factory less case or improperly packed. Repair attempts by anyone other than authorized service personnel will void the warranty. Proof of date of purchase will be required before warranty repairs can begin.

Parts which prove to be defective in the first year will be repaired or replaced free of charge including labor, shipped F O B our factory or a designated service center (addresses furnished upon request).

Only non-moving parts, such as electrical components, which prove defective during the second year are warranted. Meter movements will not be covered. All units qualifying for warranty service after one year are subject to a maximum service charge of \$15.00 for replacement of non-moving parts.

Items returned for warranty repair must be shipped prepaid and insured. Warranty claims are processed on the condition that prompt notification of a defect is given to Signet within the warranty period. Signet shall have the sole right to determine whether in fact a warranty situation exists.

The Signet warranty does not cover travel time, mileage expenses, removal, reinstallation, or calibration.

Signet is continually making design changes and improvements that adapt to the original circuit configuration. These will be incorporated as required in older units on a minimal-charge basis while under warranty.

CONSEQUENTIAL DAMAGES

Signet Scientific Company shall not be liable for special consequential damages of any nature with respect to any merchandise or service sold, rendered, or delivered.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

7.0 MANUAL CHANGE INFORMATION

Signet continually strives to keep up with the latest electronic and design developments by adding circuit, component, and design improvements to its instruments as soon as they are developed and tested. Sometimes, due to printing and shipping requirements, we cannot immediately get these changes into printed manuals. Therefore, your manual may contain new change information on the following pages. A single change may affect several sections. Be sure to make all changes within the appropriate sections of this manual.



Witcher Construction Company
General Contractors

SUBCONTRACTOR/VENDOR LIST

Calgon Water Treatment Facility
2935 Jersey, St. Louis Park, MN 55416
Project Manager: Dennis McEvoy
Project Superintendent: Marv Bartz

Job # 8515

<u>SECTION NO.</u>	<u>DESCRIPTION</u>	<u>SUBCONTRACTOR/VENDOR</u>	<u>TYPE</u>	<u>CONTACT</u>	<u>PHONE</u>
01000	General Conditions	Witcher Construction Co.	S	Dennis McEvoy	544-2727
02100	Site Clearing	Imperial Developers	S		
02200	Earthwork	Imperial Developers 9001 Grand Avenue S. Bloomington, MN 55420	S	Marty	881-6464
02240	Blacktop	Minnesota Roadways 229 W. 79th St. P. O. Box 279 Chanhassen, MN 55317	S	Dick Wronski	934-0296
02801	Sod	Glenn Rehbein Excavating Inc. 7309 Lake Drive Lino Lakes, MN 55038	M		784-0657
02800	Landscaping	Mike Winge Landscaping Inc. 13784 Lake Drive Forest Lake, MN 55025	S	Mike Winge	464-5222
03200	Concrete Reinf.	Rebarfab, Inc. 720 1st Street S.W. P.O. Box 12267 New Brighton, MN 55112	M	Lyman Spargus	633-3337
03200	Rebar Replace. (Labor Only)	Danny's Construction 3549 Eagle Creek Rd. Shakopee, MN 55379	S	Larry Wilson	445-4143
03300	Cast-i-p Concrete	Witcher Construction Co.	S	Dennis McEvoy	544-2727

SUBCONTRACTOR/VENDOR LIST (Job # 8515)
 Calgon Water Treatment Facility
 Page 2

<u>SECTION NO.</u>	<u>DESCRIPTION</u>	<u>SUBCONTRACTOR/VENDOR</u>	<u>TYPE</u>	<u>CONTACT</u>	<u>PHONE</u>
03420	Precast Concrete	Spancrete Midwest Box AA, Highway 152 Osseo, MN 55369	S	Steve Bush	425-5555
04200	Masonry Brick Only	Midwest Brick & Supply Co. P. O. Box 26528 St. Louis Park, MN 55426	M		929-0321
04200	Unit Masonry	Serice Construction 7109 Cahill Avenue East Inver Grove Heights, MN 55075	S	Sanny Anderson	451-9310
05500	Misc. Metal	Anderson Iron Works Inc. 5335 N. County Rd. 18 Minneapolis, MN 55428	M	Dick Grover	559-4533
06100	Rough Carpentry	Witcher Construction Co.	S		544-2727
07500	Membrane Roofing	Curran V. Nielsen 6600 Oxford Street Minneapolis, MN 55426	S	Dennis Rosenquist	925-3222
07600	Sheet Metal	Curran V. Nielsen	S		925-3222
07900	Caulking	Carciofini Caulking 3216 N. Rice St. St. Paul, MN 55112	S	Ron Carciofini	483-4618
08110	Hollow Metal Doors & Frames	Gardner Hardware 515 Washington Ave. N. Minneapolis, MN 55401	M	Ray Alstadt	333-3393
08360	Overhead Door	Crawford Door Co. 1641 Oakdale Ave. West St. Paul, MN 55118	S	Clark Lindstrom	455-1221

SUBCONTRACTOR/VENDOR LIST (Job # 8515)
Calgon Water Treatment Facility
Page 3

<u>SECTION NO.</u>	<u>DESCRIPTION</u>	<u>SUBCONTRACTOR/VENDOR</u>	<u>TYPE</u>	<u>CONTACT</u>	<u>PHONE</u>
08700	Finish Hardware	Gardner Hardware	M	Ray Alstadt	333-3393
08850	Glass & Glazing	Heat Miser Bradford & Hwy. 47 P. O. Box 338 Isanti, MN 55040	S	John Wojak	444-9234
09330	Quarry Tile	Twin City Tile & Marble Co. 219 E. Island Avenue Minneapolis, MN 55401	S		379-2825
09900	Painting	Prindle Painting Co. R. R. 1, Box 82 Loretto, MN 55357	S	Dennis Prindle	478-9785
15000	Mechanical	NewMech Companies 1633 Eustis Street St. Paul, MN 55108	S	Eddie King/ Phil O'Brien	642-3532
16000	Electrical	Spencer Electric 550 S. Willow Drive Long Lake, MN 55356	S	Steve Kaster	476-1211
16000	Electrical - Temp Hookups, Pole Removal	Parsons Electric 917 5th Avenue S. Minneapolis, MN 55404	S		339-8761

KEENE
CORPORATION
LIGHTING DIVISION

**INSTRUCTIONS
FOR INSTALLING
WallCube™ Luminares
"300" SERIES**



CAUTION: When connected to electrical service, these luminaires carry dangerous voltages. When replacing lamps or otherwise servicing luminaires, observe all precautions usually taken in handling high voltage equipment.

This luminaire is designed for outdoor lighting and should not be used in areas with limited ventilation or within enclosures with high ambient temperatures.

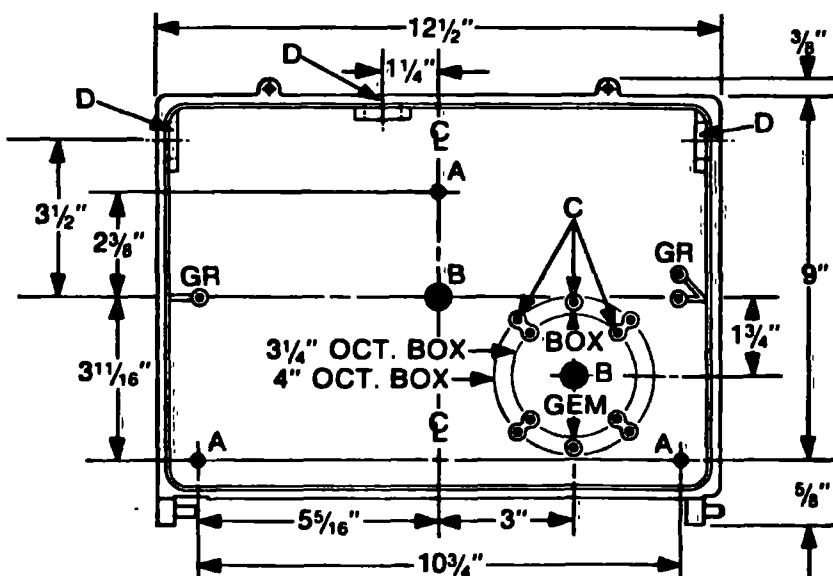
INSTALLATION

WallCube® luminaires are designed to be mounted on any surface. The inside surface of the WallCube back plate has a cast-in drill and knock-out template to match virtually any standard recessed junction box, as well as knockouts for three 5/16" mounting holes

("A"). Three 1/2" NPS tapped holes ("D") are also available for surface conduit, photo-control, etc.

MOUNTING

1. Remove the reflector.
2. Prepare the back plate for mounting by drilling or knocking out the appropriate holes.
3. Line up the back plate in desired location and mount securely.
4. Complete the wiring to the power source and ground (see wiring instructions).
5. Reassemble the reflector, install the lamp and mount the refractor (lens) assembly.



- "A" are 5/16" diam. knockouts
- "B" are 9/16" diam. knockouts
- "C" are knockouts for #10 screw clearance
- "D" are 1/2" NPS tapped holes

Fig. 1 Drill and knock-out Template inside back plate of fixture.

IMPORTANT: To weather-proof your outdoor installation be sure to seal all holes in fixture housing (mounting, conduit, plugs, photocontrols, etc.) with Duxseal or equivalent sealer.

WIRING

Units built for a specific voltage are completely factory-wired. Double check your power source to make sure the supply voltage is compatible with the unit.

"Multi-Tap" (M-T) units may be used with a choice of 120V, 208V, 240V and 277V, pro-

vided that proper transformer leads are connected in the field. For example, if your supply voltage is 208V, connect the "hot" supply wire to 208V ballast tap and the "common" supply wire to transformer "common" wire. Make sure all of the unused leads are properly capped.

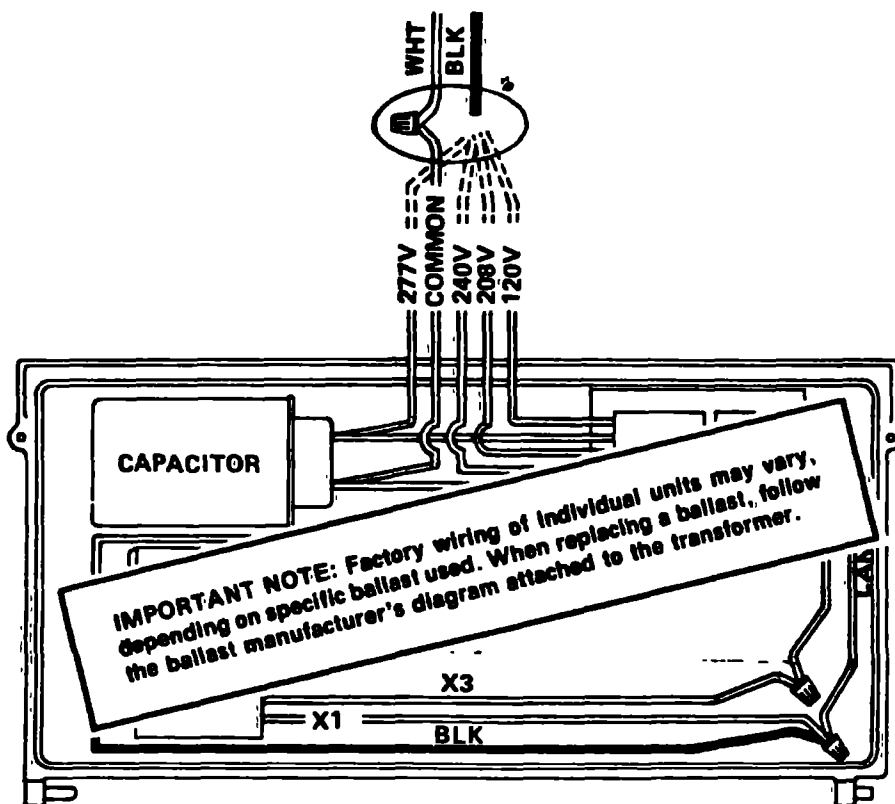


Fig. 2. Typical wiring diagram of a "Multi-Tap" WallCube. Shown is a high pressure sodium unit. Only the circled connections need to be completed in the field.

ATTACHING LEXAN SHIELD AND/OR WIRE GUARD

Optional Lexan shield and/or wire guard are

attached over the glass refractor by means of 4 self-tapping screws supplied. The screws fit into blind holes cast into the lens frame.

LIMITED ONE YEAR WARRANTY

Keene fixtures are guaranteed against mechanical and electrical defects for a period of one year from date of delivery. Replacement or repair of authorized returns found to be mechanically or electrically defective within the guarantee period constitutes fulfillment of all obligations under this warranty. Keene assumes no responsibility for the proper installation of its products, or for labor costs involved in repair or replacement. Ballasts are covered by manufacturers trade warranties. Full statement of Keene limited warranty policy available on request.



Carlisle SynTec Systems

Carlisle SynTec Systems
Division of Carlisle Corporation
P O Box 7000
Carlisle PA 17013
(717) 245-7000, Telex 84-2511 (SynTec CLSL)



CONGRATULATIONS!

We are happy to present your Carlisle Warranty Package! Your new Carlisle roof is constructed of the finest roofing materials available. In addition, your roofing contractor is an Authorized Carlisle Applicator who has been trained by Carlisle to install your roof according to our specifications and details. Under these conditions, your roof should give you years of satisfactory performance.

Enclosed in this package is your Warranty, Attention Card (to be placed on the roof), Care & Maintenance Instruction Sheet, and a questionnaire regarding your satisfaction with the performance of your new Carlisle Roofing System. At this time, we would like you to take a few moments to review the enclosed materials carefully, and contact Carlisle if you have any questions regarding your warranty.

In addition, we would also appreciate your comments regarding your Carlisle Roofing System on the post card. Please answer the questionnaire and return it to Carlisle so that we will know if you, the building owner, are satisfied with your new roof. Your comments will help Carlisle to protect the watertight integrity of your new roof. You may also contact us by using the toll-free phone numbers listed below.

We are pleased to have you as a customer, and hope that if your future needs require a new roofing system, you will again choose Carlisle!

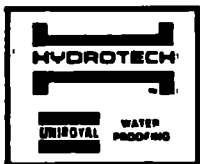
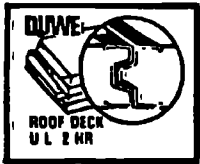
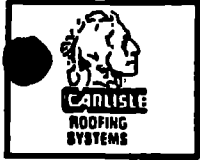
Sincerely,

A handwritten signature in cursive script, reading "Kem W. Scott".

Kem W. Scott
Vice President
Marketing & Customer Services

Call toll-free: 800/233-0551
in PA: 800/932-4626



**CURRAN V. NIELSEN ROOF WARRANTY EXEMPTION NOTIFICATION**

With the notice of a roof problem, CURRAN V. NIELSEN CO. will, on the owner's behalf, investigate the roof problem. Should the investigation reveal the problem to be outside the scope of the warranty, investigation and repair costs will be the responsibility of the owners.

Examples of roof leaks not covered under the warranty:

1. Cracked walls.
2. Uncaulked wall louvers.
3. Roof pipes without hoods.
4. Windows uncaulked (Leaking windows).
5. Tears in the roof membrane.
6. Leaking mechanical units.
7. Leaking sprinkler systems or plumbing pipes.
8. Leaking roof drains (Plumbing).
9. Damage by TV or Cable installers.
10. Installation of TV antennae by Custodians.
11. Other items not related to the roofing work.

CARLISLE
AUTHORIZED
ROOFING CONTRACTOR
TRAINED AND QUALIFIED
W. L. Hanning
PRESIDENT

AN EQUAL OPPORTUNITY EMPLOYER

Carlisle SynTec Systems

Carlisle SynTec Systems
Division of Carlisle Corporation
P O Box 7000
Carlisle, PA 17013
(717) 245-7000, Telex 84-2511 (SynTec CLSL)

CARLISLE

JANUARY 03, 1986

071

NIELSEN, CURRAN V., COMPANY, INC.
6600 OXFORD STREET
MINNEAPOLIS
MN 55426

CALGON REILLY TAR & CHEMICAL PUMPHSE
2935 JERSEY
ST. LOUIS PARK
MN 55426
CMD# 6392-85
.045 EPDM

TWENTY YEAR MEMBRANE MATERIAL WARRANTY

Subject to the following terms and conditions, Carlisle SynTec Systems, Division of Carlisle Corporation, (SELLER) warrants to the Buyer that the Sure-Seal® non-reinforced rubber membrane (MEMBRANE) sold as "First grade" will be free from manufacturing defects at the time of its delivery to the job site.

If upon inspection by the Seller, the membrane evidences manufacturing defects, Seller's liability and Buyer's remedies are limited, at Seller's option, to the repair or replacement of the defective membrane at the F.O.B. point in the original contract of sale.

We further warrant that the Membrane material will not prematurely deteriorate to the point of failure because of weathering for a period of twenty (20) years from the date of sale if properly installed, maintained and used for the purpose for which the Seller intended.

Buyer shall give Seller notice of a breach of warranty within thirty (30) days of discovering the premature deterioration of the Membrane.

If upon inspection by the Seller, the Membrane shows premature deterioration because of weathering within the twenty (20) year period stated herein, Seller's liability and Buyer's remedies are limited at Seller's option to the providing of repair material for the original Membrane or credit to be applied towards the purchase of a new Membrane, the value of these remedies being determined by the Seller based upon the number of remaining months of the unexpired warranty used to pro-rate at the current prices for the Membrane. The maximum pro-rated value allowed by Seller for repair on credit shall not exceed the original Membrane purchase price.

NO REPRESENTATIVE OF THE SELLER HAS AUTHORITY TO MAKE ANY REPRESENTATIONS OR PROMISE EXCEPT AS STATED HEREIN.

THERE ARE NO WARRANTIES EITHER EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THE WARRANTIES CONTAINED IN THIS DOCUMENT. CARLISLE SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF PROFITS OR DAMAGES TO THE STRUCTURE OR ITS CONTENTS.

CARLISLE SYNTec SYSTEMS
DIVISION OF CARLISLE CORPORATION

By Hugh C. Kenney, Sr.
HUGH C. KENNEY
SR. VICE PRESIDENT-MARKETING & SALES

HCK:clz



Carlisle SynTec Systems

Carlisle SynTec Systems
Division of Carlisle Corporation
P.O. Box 7000
Carlisle, PA 17013
(717) 245-7000; Telex 84-2811 (SynTec CLBL)

CARLISLE

Serial No. 47554

CARLISLE SURE-SEAL™ MEMBRANE SYSTEMS WARRANTY FOR COMMERCIAL BUILDINGS

Building Owner: CALGON CORP.

Building: CALGON REILLY TANK & CHEMICAL PUMPHOUSE CMD# 6392-85

Location: ST. LOUIS PARK, MN

Date Installation is Completed: DECEMBER 15, 1985

Date Inspection of Installation is Completed: E B WAKKANIKY (01/03/86)

Roof Approved By: CARLISLE SYNTec SYSTEMS

Carlisle SynTec Systems, DIVISION OF CARLISLE CORPORATION, ("CARLISLE"), warrants to the Building Owner, ("Owner"), of the commercial building described above, that subject to the terms, conditions, and limitations stated herein, Carlisle will repair any leaks in the Carlisle Sure-Seal™ Membrane System ("Membrane System"), but Carlisle's obligations shall not exceed the Owner's original cost of the installed membrane over the life of this Warranty, installed by a Carlisle Authorized Roofing Applicator for a period of 10 years commencing with the date of the final inspection and acceptance of the Membrane System installation by Carlisle.

TERMS, CONDITIONS, LIMITATIONS

- Owner shall provide Carlisle with written notice within thirty (30) days of the discovery of any leaks in the Membrane System.
- If, upon Carlisle's inspection, Carlisle determines that the leaks in the Membrane System are caused by defects in the Carlisle Membrane System's material or workmanship of the Carlisle Authorized Roofing Applicator, Owner's remedies and Carlisle's liability shall be limited to Carlisle's repair of the Membrane System.
- This Warranty shall not be applicable if any of the following shall occur:
 - The Membrane System is damaged by natural disasters, including, but not limited to, lightning, strong gales, hurricanes, tornadoes, and earthquakes, or
 - The Membrane System is damaged by any acts of negligence, accidents, or misuse, including but not limited to, vandalism, civil disobedience, or acts of war, or
 - Metal work or other material not furnished by Carlisle is used in the Membrane Systems and causes leaks.
- This Warranty shall be null and void if any of the following shall occur:
 - If, after installation of the Membrane System by a Carlisle Authorized Roofing Applicator there are any alterations or repairs made on or through the roof or objects such as, but not limited to, structures, fixtures, or utilities are placed upon or attached to the roof without first obtaining written authorization from Carlisle, or
 - Failure by the Owner or lessee to use reasonable care in maintaining the roof, or
 - Owner fails to comply with every term or condition stated herein.
- During the term of this Warranty, Carlisle, its agents or employees, shall have free access to the roof during regular business hours.
- Carlisle shall have no obligation under this Warranty until all bills for installation, supplies and service have been paid in full to the Carlisle Authorized Roofing Applicator and material suppliers.
- Carlisle's failure at any time to enforce any of the terms or conditions stated herein shall not be construed to be a waiver of such provision.
- This Warranty supersedes and is in lieu of any and all other expressed warranties that are in conflict with the terms and conditions stated herein.

THE REMEDIES STATED HEREIN ARE THE SOLE AND EXCLUSIVE REMEDIES FOR FAILURE OF THE ROOFING SYSTEM OR MEMBRANE. THERE ARE NO WARRANTIES EITHER EXPRESSED OR IMPLIED WHICH EXTEND BEYOND THE FACE HEREOF. CARLISLE SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR DAMAGE TO THE BUILDING OR ITS CONTENTS.

CARLISLE SYNTec SYSTEMS
DIVISION OF CARLISLE CORPORATION

BY: HUGH C. KENNEY

AUTHORIZED

SIGNATURE: *Hugh C. Kenney, Sr.*

TITLE: SENIOR VICE PRESIDENT OF MARKETING & SALES

DATED: JANUARY 03, 1986





Carlisle SynTec Systems
Division of Carlisle Corporation
P.O. Box 7000
Carlisle, PA 17013
800-233-0551
800-932-4826 in PA

Carlisle SynTec Systems



CARLISLE SURE-SEAL® UNIVERSAL ROOFING SYSTEMS

Care & Maintenance Information

You have just received a Carlisle Sure-Seal Roof Warranty. The roofing system used contains one of the finest available roofing materials on the market today.

Following is a list of maintenance information which is recommended for a Carlisle Sure-Seal Roofing System. These items will help you obtain the maximum performance from your roof.

1. Keep roof surface clean at drain areas to avoid clogging of drains. This will avoid overloading of the roof surface
2. Keep all petroleum products off the rubber membrane—solvents, greases, oil, or any liquid containing a petroleum product — to avoid degrading the membrane.
3. Kitchen wastes should not be exhausted onto the roof surface. Depending on type and quantity, they could degrade the membrane.
4. If your roof will come in contact with any chemicals, please contact Carlisle, since some chemicals could degrade the membrane.
5. Keep foot traffic to a minimum. Walkways should be provided if regular traffic is required or if roof-top equipment has a regular thirty (30) day or less maintenance schedule. **CAUTION:** Slippery when wet. Carlisle recommends the placement of walkways to and from all areas needing maintenance. Exercise caution when not walking on walkways.
6. **DO NOT** use roof cement to repair or install the rubber membrane—roof cement contains petroleum products.
7. Temporary repairs can be made with Carlisle's Lap Sealant or any good grade rubber caulk. Notify Carlisle of this action in writing.
8. Keep roof maintenance items, such as counterflashing, metal curbs and metal pipes, sealed watertight at all times.
9. If you do have a leak, make sure that it is a roof membrane leak problem and that it is not just a curb, skylight, metal duct work or plumbing leak causing the problem. The investigation and repair costs must be paid by the owner if the problem is found to be outside the scope of the warranty.
10. If a new unit or pipe must be installed through the roof or there is an addition to the building, contact Carlisle for an approval and coordinate the installation with the Carlisle Approved Applicator so the tie-in will be in accordance with Carlisle's specifications and warranty.

The preceding information is for the Sure-Seal Roofing Systems. There is no maintenance required for the Sure-Seal membrane, splice or flashing used in the system. Your cooperation in the maintenance and use of the roof will be appreciated.

ATTENTION!

THIS IS A CARLISLE SURE-SEAL™ ROOF.

Mechanical Damage To This Roof Is Not Covered By The Warranty

USE WALKWAYS WHERE PROVIDED!!

ROOF MAINTENANCE

EMERGENCY REPAIRS MAY BE MADE BY THE OWNER.
HOWEVER, THIS IS A WARRANTED ROOF REQUIRING
MAINTENANCE BY A CARLISLE APPROVED APPLICATOR
IN ORDER TO MAINTAIN THE WARRANTY.

MANUFACTURER

CONTACT:
Carlisle SynTec Systems

717-245-7000
800-233-0551
IN PA. 800-932-4626

ROOFING CONTRACTOR

PHONE NUMBER

NIELSEN, CURRAN V., COMPANY, INC.

612-925-3222

CMD NO. 6392-85 JOB NO. 071850467 AB NO.

WARRANTY NO. 47354

10 YEAR WARRANTY IN EFFECT BEGINNING JANUARY 03, 1986

Carlisle SynTec Systems





Sure-Lites[®]

SELF POWERED EXIT SIGNS

INSTRUCTION MANUAL

IMPORTANT SAFEGUARDS

When using electrical equipment, basic safety precautions should always be followed including the following:

1. Read and Follow All Safety Instructions.

2. Do not use outdoors.
3. Do not mount near gas or electric heaters.
4. Equipment should be mounted in locations and at heights where it will not readily be subjected to tampering by unauthorized personnel.
5. The use of accessory equipment not recommended by *Sure-Lites* may cause an unsafe condition.
6. Do not use this equipment for other than its intended purpose.
7. Some equipment covered by this manual is approved for remote fixtures. This equipment does not require a load fuse because its sophisticated solid state transfer switch is current limited. Check load rating of equipment to calculate remote capability. The (2) 29-82 lamps are equal to 7.2 watts. Fixtures that may be mounted on the sides of the exit sign are equal to 7.2 watts each. **DO NOT exceed TOTAL OUTPUT RATING of equipment. TRANSFER CIRCUIT will automatically shut down if overloaded.**

8. SAVE THESE INSTRUCTIONS.

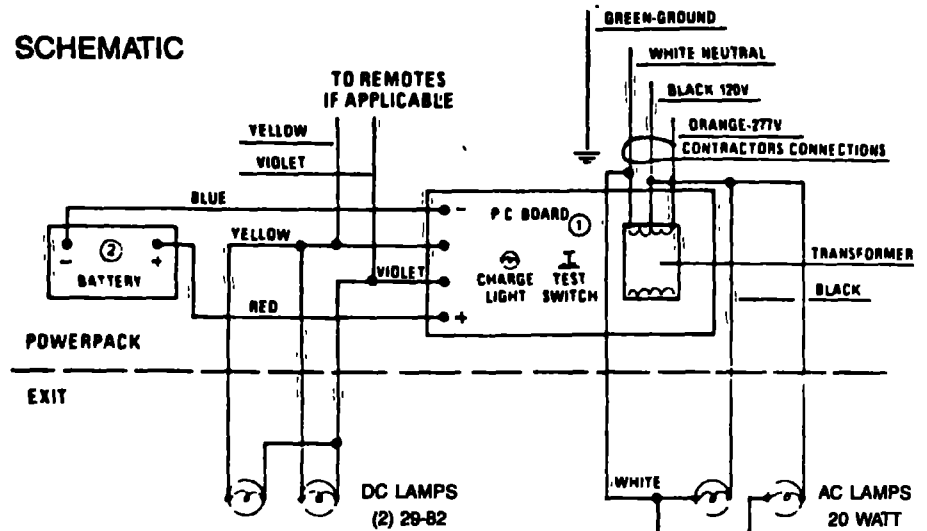
Sure-Lites
Halo Lighting Division
341 Christian Road
Oxford, Connecticut 06483

203 264 1700
Telex 962487

Sure-Lites[®]

SL#49-53

SCHEMATIC



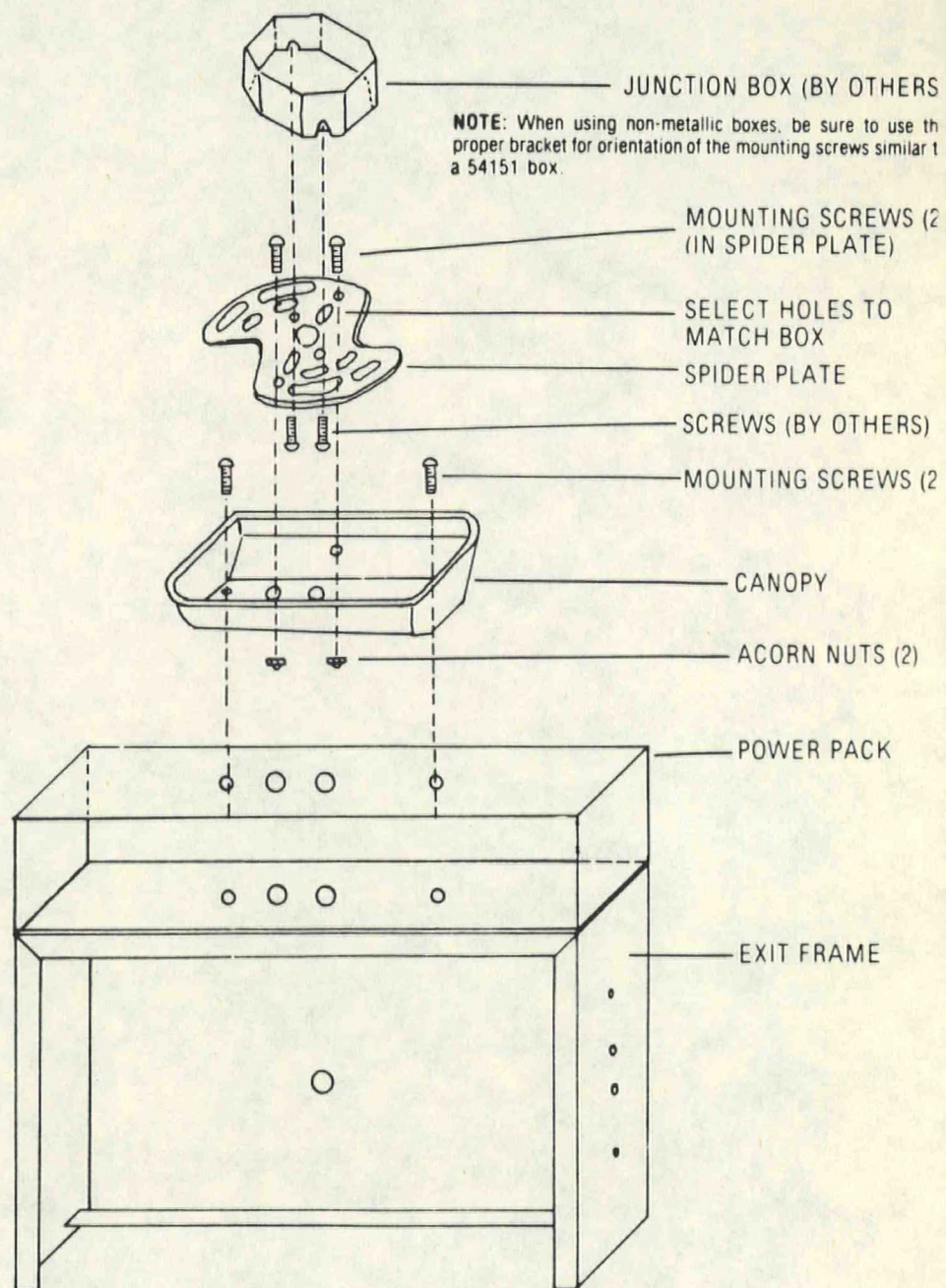
RATINGS and REPLACEABLE PARTS LIST

Input: 60 Hz 46 Watts (incl. AC lamps)
Output: 6VDC

MODEL #	WATTS FOR 90 MINS	P.C. BOARD	STANDARD ^① LAMP	BATTERY
120/277 VOLT				
UN—	7.2	51-3651	29-82	26-2
UN—XJ	7.2	51-3651	29-82	26-17
UNH— ^③	21	51-3652	29-82	26-1
UNH—XJ ^③	12	51-3652	29-82	26-13
UN2H—XJ ^③	24	51-3660	29-82	2 (26-13) ^②
120 VOLT 277 VOLT				
EP	7.2	51-3653 51-3651	29-82	26-2
EP—XJ	7.2	51-3653 51-3651	29-82	26-17
EPH— ^③	21	51-3650 51-3652	29-82	26-1
EPH—XJ ^③	12	51-3650 21-3652	29-82	26-13
EP2H—XJ ^③	24	51-3660 51-3660	29-82	2 (26-13) ^②

NOTES:

- ① Numbers shown are standard lamps supplied. However, check lamp replacement label as your installation may have been custom designed.
- ② Batteries are in parallel. Replace both at same time.
- ③ UNH units may be followed by suffix SH or DH indicating 1 or 2 fixtures mounted on exit signs. These lamps are 7.2 watts each and the lamp replacement number is 29-75.



INSTALLATION

Wall Mounting:

1. Extend unswitched 24 hour AC supply of rated voltage to junction box (by others). Leave at least 18 inches of slack. Circuit should not be energized at this time.
2. If remote lamps are to be connected to this equipment, extend DC circuit per article 720 of the NEC.
3. Disassemble sign by removing bottom screw in steel signs and sliding the sign stencil and color sheet inward and downward. In aluminum signs there is no screw (except tamperproof installation). Slide stencil and color sheet upward and lift from bottom.
4. Remove the power pack cover by taking out the center screw.
5. Knock out the appropriate mounting pattern and wire pass hole to fit junction box used. Use plastic bushings provided to protect wires from metal edge. Tie wires with wire tie provided. Bring wires through back of sign and mount securely to box.
6. Connect wires per schematic and color code as follows: Line 277V - orange; Line 120V - black; Neutral - white. Cap unused line lead. Connect ground in accordance with local codes if remotes are to be powered, connect DC circuit to yellow and violet leads.
7. Install AC & DC lamps in appropriate sockets.
8. Connect battery leads.
9. Turn on AC supply and operate test switch. AC lamps will stay on and observe that DC lamps come on. Release test switch. DC lamps will go out and charge light will burn brightly. As battery reaches full charge the light will dim.
10. Replace power pack cover and close up fixture by reversing steps 3 and 4.

Ceiling or End Mount

1. Be sure to use *Sure-Lites®* Canopy Kit.
2. Follow steps 1 to 4 of wall mounting instructions.
3. If double face sign is required, convert the single face supplied.
STEEL: Remove screw at bottom of sign and slide out back plate with an inward and downward motion. Replace back panel with extra stencil and color sheet supplied with this sign and replace screw.
ALUMINUM: Remove retaining screw from back plate on back of sign. Remove plate with an upward and outward motion. Do not install extra color sheet and stencil supplied with sign until sign is mounted as no retaining screw is used in this double faced sign.
4. Knock out the appropriate mounting pattern on top or side of unit to accommodate canopy. Use plastic bushings provided to protect wires from metal edge. Tie wires with wire tie provided.
5. Fasten canopy to exit sign by means of (2) self threading screws provided.

6. Screw machine screws all the way into the spider plate.
7. Mount spider plate to junction box by choosing proper slots and using screws supplied with junction box.
8. Feed wires through spider plate and exit sign and fasten exit canopy combination to spider plate using (2) acorn nuts provided.
9. Follow steps 6 to 10 of wall mounting instructions.

MAINTENANCE

None required. Replace batteries every 8 to 10 years according to ambient. XJ batteries require replacement every 12 to 15 years. However, we recommend that equipment be tested regularly in accordance with local codes.

NOTE: Servicing of any parts should be performed by qualified service personnel. Replace only with parts and batteries supplied by *Sure-Lites*.

OPERATION

1. To test, depress test switch. Charge indicator will go out and DC lamps will come on. AC lamps will stay on.
2. Release test switch. DC lamps will extinguish and charge indicator will come on.
3. A bright charge indicator indicates high charge. After the battery has reached full charge, the indicator will dim.

CAUTION

This equipment is furnished with a sophisticated low voltage battery dropout circuit to protect battery from over discharge after its useful output has been used.

Allow 24 hour recharge time after installation or power failure for full load testing.

TROUBLE SHOOTING HINTS

EMERGENCY LAMPS DO NOT COME ON — PILOT LIGHT OUT BEFORE TEST.

1. Check AC supply - be sure unit has 24 hour AC supply.
2. AC supply on - Pilot light out. Replace charge circuit.
3. Pilot light on - Lamps do not light. Either output shorted or overloaded or battery not connected.

EMERGENCY LAMPS COME ON DIM.

1. Battery discharged - permit unit to charge for 24 hours and then retest. If lamps are still dim, check charger for charge function. If functioning properly, replace battery.
2. Remote lamps dim - Check wire size to remote lamps against wire size chart.

If following the above trouble shooting hints does not solve your problem, contact your local Sure-Lites Representative or the factory for assistance.



Dual-Lite EZ-2

SELF-CONTAINED EMERGENCY LIGHTING UNIT

Instructions for

INSTALLATION • OPERATION • SERVICE

SPECIFICATIONS

AC supply voltage	120-277 volts • 10%
Power consumption	15 watts
Battery type	Sealed 4 volt maintenance-free battery
Battery float voltage	4.56 volts \pm 1% @ 72°F
Discharge duty cycle	1 1/2 hours of light to 87 1/2% battery voltage
Recharge duty cycle	24 hours for full recharge from 87 1/2% battery voltage. Continuous automatic float charge operation after full charge voltage restored
Charger type	Solid state — full wave silicon diode rectification, silicon controlled rectifier output control, Zener diode voltage regulation
Transfer means	Transfer circuit in EZ-2 energizes lamps on loss of AC and disconnects lamp when normal power is restored. In EZ-2 the circuit disconnects lamps when the battery voltage drops to 70-80% of nominal during prolonged power failure to protect a battery from deep discharge or sulfation
Status indication	Pilot light shows AC is available and reflects charge rate: bright high-charge indication fades to dim glow when battery is fully charged and floating
Test means	Pushbutton switch simulates AC failure to test transfer function, battery and lamp readiness and charger response to battery discharge
Lighting head position adjustment	360° universal swivel rotation 180° tilt

Unit shipped with negative battery lead disconnected from charger module

REPLACEMENT PARTS LIST

Part Description	Dual-Lite P/N
Printed Circuit Board, EZ-2	98 630
Emergency Lamp	11-173
Lamp Housing	07-145
T-fitting	31 20
Battery	12 580
Voltmeter (optional)	19 55
Meter Retainer Cup	36 168-1

DUAL LITE

IMPORTANT SAFEGUARDS

When using electrical equipment basic safety precautions should always be followed including the following

READ AND FOLLOW ALL SAFETY INSTRUCTIONS

- 1 Do not use outdoors
- 2 Do not mount near gas or electric heaters
- 3 Use caution when servicing batteries
- 4 Equipment should be mounted in locations and at heights where it will not readily be subjected to tampering by unauthorized personnel
- 5 The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition
- 6 Do not use this equipment for other than intended use
- 7 Servicing of this equipment should be performed by qualified service personnel

SAVE THESE INSTRUCTIONS

INSTALLATION INSTRUCTIONS

■ GENERAL INSTRUCTIONS

This unit is designed for surface mounting on a wall with or without an outlet box

The unit chassis will accept 3 1/2" x 4" octagon, or 4" square outlet boxes and also standard plaster rings

There is a cutout on the top of the unit for surface wiring such as wiremold or conduit (See Fig. #1)

Provide each unit with a single unswitched supply from a 120 or 277 VAC branch circuit used for normal lighting in the area to be protected

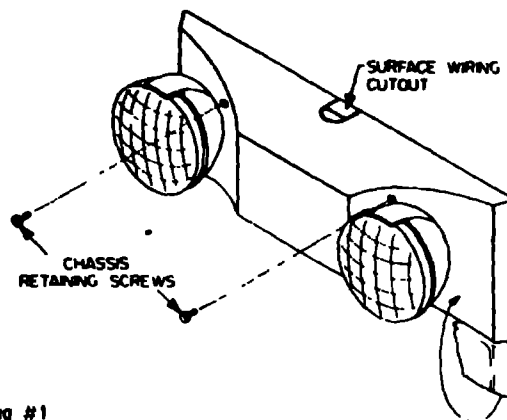


Fig. #1

■ INSTALLING THE UNIT

- 1 Fasten mounting plate to wall or junction box (Fig. #2)
- 2 Attach housing onto mounting plate with hinge straps (Fig. #2)
- 3 Make up AC supply connections using wire nuts. Select either black for 120 VAC or red for 277 VAC. Cut back and insulate unused lead (Fig. #2)
- 4 Close wiring compartment cover (Fig. #2)
- 5 Connect battery lead to terminal on printed circuit card (Fig. #3)
- 6 Swing chassis up and tighten retaining screws (Fig. #1)
- 7 Energize AC input power
- 8 Adjust emergency lamp to desired angle

*Caution: Damage to the battery may occur if the battery lead is left connected for a prolonged period of time without AC power provided

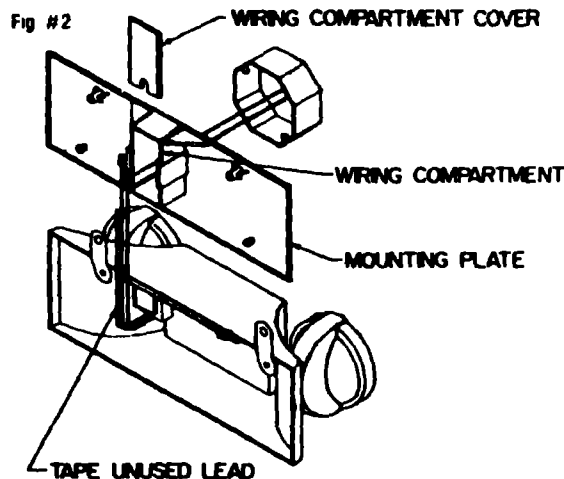


Fig. #2

EZ-2

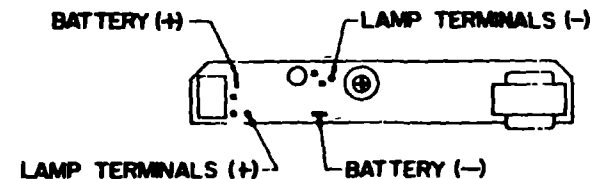


Fig. #3

Upon initial energization of the AC circuit, the status lamp will typically stay at full brilliance for several hours before fading to the dim state that means the battery has charged to its normal float level. If this 'ready' indication occurs too quickly (within 4 hours), this may mean that a degree of sulfation has occurred within the battery due to cell discharge during storage. To be sure that any such condition is eliminated, perform one or more battery conditioning cycles as described under Routine Care.

■ REPLACING THE CHARGER/BATTERY PRINTED CIRCUIT ASSEMBLY

- 1 De-energize AC power to unit
- 2 Loosen two cover retaining screws, open unit, disconnect battery lead
- 3 Open wiring compartment cover. Disconnect AC input wires. Close cover
- 4 Pull emergency lamp wires off PC assembly. Remove test switch button, take out PC assembly

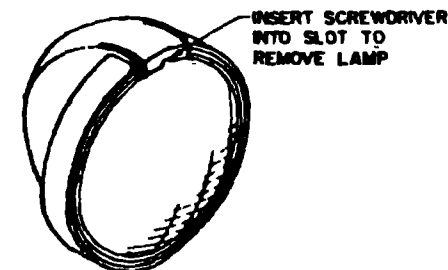
To replace the assembly, simply reverse the procedure

■ REPLACING AN EMERGENCY LAMP

To remove lamp, place screwdriver into slot, twist and pop out lamp (Fig. #4). Pull lamp out until the lamp base is reachable. If both the lamp that is being replaced and the replacement lamp have terminals, change directly. If either lamp has wireleads attached, the following must be done:

- 1 Cut leadwires on the lamp being replaced as close to lamp as possible
 - 2 If replacement lamp has wireleads, cut them to approximately three inches and wirenut (supplied) to leadwires from unit
 - 3 If replacement lamp has terminals, crimp female insulated terminals (supplied) to unit leadwires and then connect to replacement lamp
- Reassemble lamp assembly

Fig. #4



THE HISTORY OF THE

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